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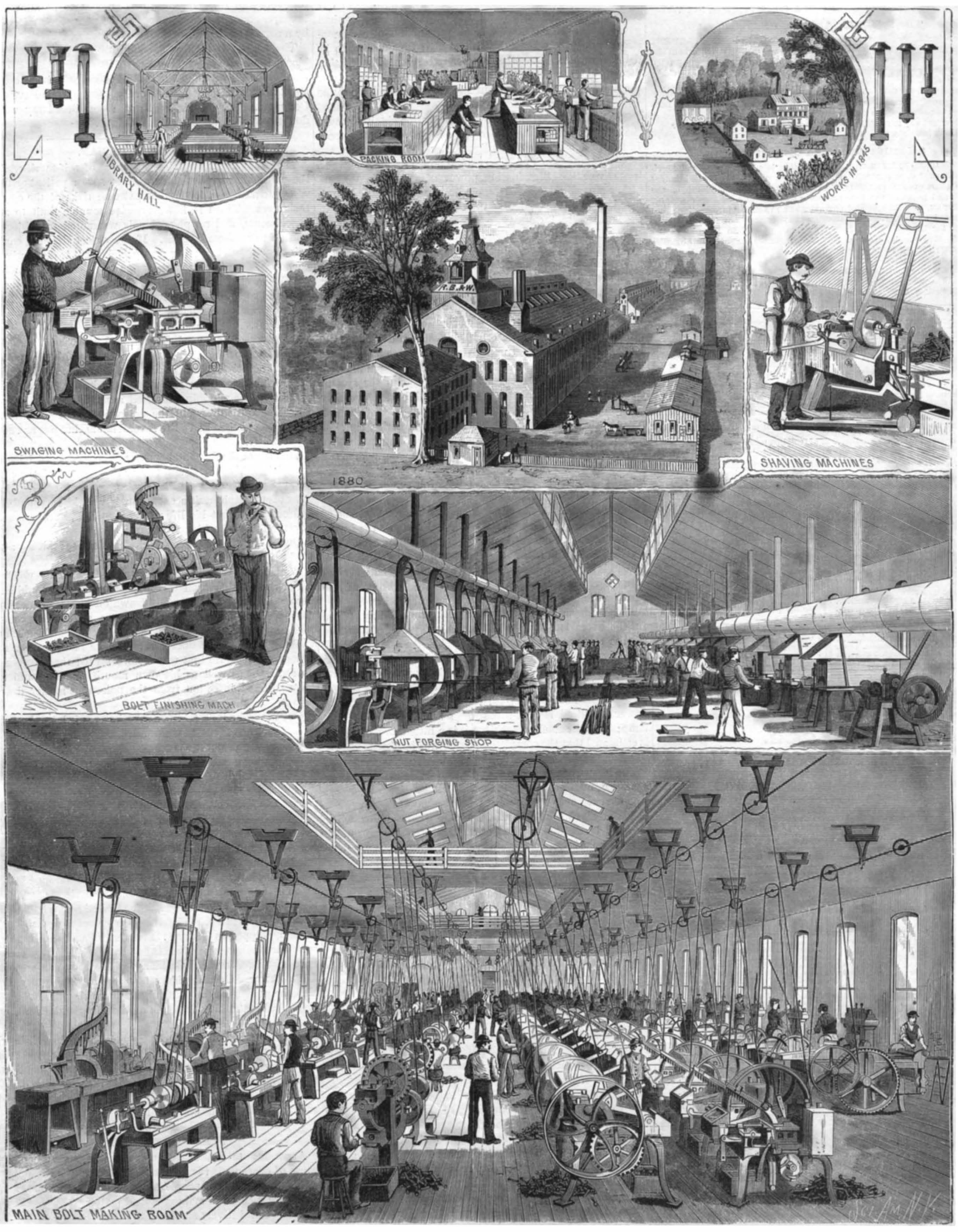

THE MANUFACTURE OF BOLTS AND NUTS—RUSSELL, BURDSALL & WARD PORT CHESTER, N. Y.—[See page 21.]

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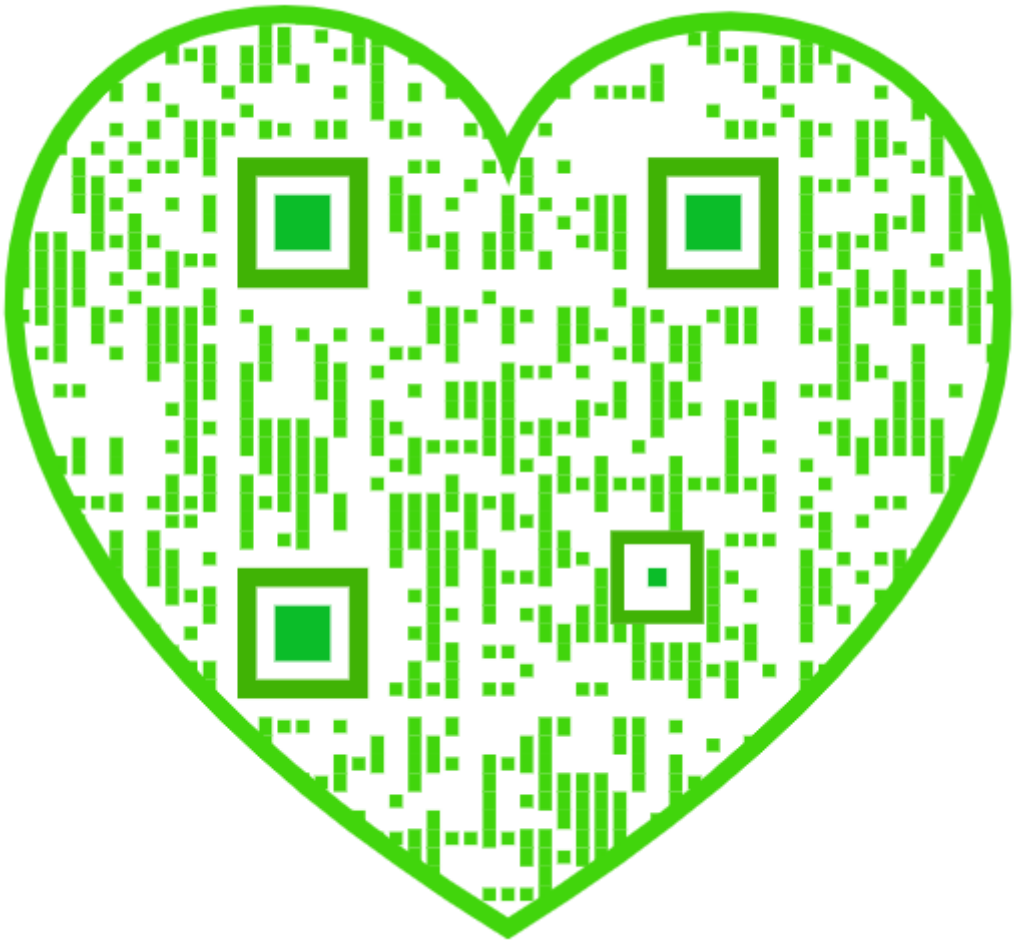

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THE ELECTRIC LIGHTS ON BROADWAY, NEW YORK.

In our issue dated December 25 mention was made of preparations going on for the experimental lighting of a section of Broadway with electric lamps. The promises of the company making the test—the Brush Electric Light Company, of New York—were fulfilled somewhat ahead of the time fixed, and on the night of December 19 the twelve blocks between 14th and 26th streets, including a portion of Madison square, were lighted by sixteen lamps on a single circuit. Although there were already in use in this city, in private establishments, something like a hundred Brush lamps, this was the first application of them to street lighting here, and the experiment naturally attracted much attention. The company proposes to continue the exhibition of the lamps for a month or more, keeping a careful record of the several elements of cost, so that an authoritative decision can be arrived at touching the economy of the system and its ability to take the place of gas in the lighting of our streets. That the electric light is very much cheaper than gas, quantity for quantity, is already abundantly demonstrated and pretty generally recognized; the question to be determined now is whether the vastly brighter illumination demanded when electricity is used, and is really needed for the satisfactory lighting of our streets, can be had at a price which the public is willing to pay.

The difference in the degree of illumination obtained under the two systems is far greater than is popularly supposed. In the section of Broadway lighted by electricity there are sixteen lamps—each of 2,000 candle power—each having at least twice the illuminating power of all the gas lights hitherto used there. Anywhere in the electrically illuminated district it is possible to read type of the size used in the SCIENTIFIC AMERICAN, and the light is purer and more steady than any gas light. Yet the popular impression at first was that the electric light was a trifle dim, and that the lamps should have been placed nearer together.

The company making this experiment was organized under the laws of this State some time last fall, its field of operation being limited to Manhattan Island. As already noted, the Brush system of lighting had been adopted in quite a number of our larger mercantile establishments, and many other merchants and manufacturers favored its introduction, but did not require lamps enough to warrant the purchase of separate generating machines. The success of the system elsewhere made it probable that it would be as favorably received here, and that its general use might be extended not only to the larger shops, warehouses, factories, etc., but also to the public streets and parks. Accordingly the New York company was organized to develop the field. The district selected for the first central station includes a large number of prominent hotels, club houses, theaters, and other places of amusement, and covers what has become the chief shopping district of the city. Seeing the favorable issue of the first street experiment, it is safe to infer that the future progress of the electric light in this city will not be slow. At this writing the wires have been set up as far as 34th street, and it is expected that the company will be officially invited at an early day to submit a bid for the lighting of the square mile of territory around the central station.

Ample preparations are making at the preliminary station for the extension of the system. Already half of a double Corliss engine of 200 horse power has been set up, with three dynamo machines, each capable of sustaining sixteen lamps of 2,000 candle power. Foundations are being prepared for half a dozen more machines of the same size, and one 40-light machine. With the latter type of machine the power required is four-fifths of a horse power to each lamp; with the smaller machines it is a little more, though it is estimated that the completed engine will be able to supply 250 lamps of 2,000 candle power each.

The lamps are of simple construction, very plain in appearance, relatively inexpensive and easy to keep in order. The street lamps are provided with two sets of carbons, each good for eight hours' burning, and so adjusted that when one set is exhausted the current shifts to the other. No clockwork is employed in feeding the carbons, their movement being effected by a simple automatic electric arrangement, which secures a constant adjustment and a remarkably steady light.

It is evident that the contest between gas and electricity for the lighting of our streets has now passed from the theoretical to the practical stage. It is tolerably clear, too, that popular sympathy has a decided leaning toward electricity. It is to be hoped that on the score of cost the tests will result as favorably as they have in respect to the quality of the light.

GROOVE TRACK PAVEMENT.

In his much repeated lecture on "Lost Arts," Mr. Wendell Phillips describes an ancient roadway—Assyrian, if we recollect aright—which was made of stone blocks grooved for the wheels of wagons.

Something similar would seem to be proposed by the Groove Track Pavement Company, of this city, which has applied for permission to place in lower Broadway and the streets leading therefrom to the ferries a complete equipment of five sets of tracks, with three tracks in each set to suit the gauge of every kind of vehicle. The petitioners also ask the privilege of constructing an experimental set of tracks in Union square, as "an entering wedge" toward laying in every street in the city such tracks as would permit the use of compressed air as a motor for all sorts of vehicles. Whether these tracks are to be accounted public highways does not appear, though if they are not it is obvious that the public would not long be left with any usable portion of their own streets, should the petition be granted. The petitioners further ask for the privilege of running light and convenient vehicles for carrying passengers and baggage, at a speed not exceeding 20 minutes from Union square to either of the ferries; vehicles to be run at intervals of two minutes; and the fare to be 5 cents, to include the carrying of 50 pounds of personal baggage. The fare, they say further, is to be prorated with all connecting omnibus and horse railroad lines that desire this arrangement, and excluding and prohibiting all other vehicles from carrying passengers, except such as now run in Broadway. In consideration for this decidedly valuable grant, the Groove Track Pavement Company proposed to keep the streets in which their tracks were laid well paved, tracked, and cleaned from dirt or snow, and to pay into the City Treasury one cent for every full fare collected, this amount to be allowed to taxpayers occupying the property bounding the said streets by a corresponding reduction of their taxes.

The scheme is put forth ostensibly for the relief of the blocked and crowded condition of Broadway. It is clear that it would put an end to blockades—by driving off the street all vehicles not owned or licensed by the Pavement Company. The business firms along Broadway would doubtless prefer an occasional "block."

AN UNWISE PHYSICIAN.

There have been no nobler instances of self-sacrifice than those recorded of physicians who, to save a patient or to investigate a disease, have taken extreme risks at the cost of their lives. There is, however, a reasonable limit to such experiments, and no physician is warranted in subjecting himself to needless hazards. If the object aimed at can be gained without incurring any special risk it is obviously the part of wisdom to choose the safer way. The spirit which impelled young Dr. Sanford to choose the more dangerous way, and so lose his life, at Greenpoint the other day, was beyond question commendable; but his act was the reverse of justifiable.

As the case is reported, Dr. Sanford had been attending a child afflicted with malignant diphtheria, watching the patient day and night. At last the air passages became blocked, and the doctor resorted to the use of the knife. He made an opening in the windpipe, inserted a small rubber tube, and with his mouth drew out the poisonous fluid. By this act he prolonged the child's life several hours, but put an end to his own life.

This is not the first fatal instance of the sort which has occurred in this country, and two or three cases of the same nature have been reported in France. The infectious character of the diphtheritic excretion is well known, and Dr. Sanford knew that his life would possibly, if not probably, pay the forfeit for his professional zeal.

Ought he to have taken the risk? More specifically: can we justify his taking the risk?

We have no hesitation in answering, "Certainly not!"

For the simple reason that the deadly matter could have been as promptly and as surely drawn off by purely mechanical means. The emergency was not a sudden one, or one that could not have been provided for beforehand. In any apothecary shop the doctor might have bought for a few cents a rubber bulb that would have served the purpose of an aspirator as well as his own mouth, and it would not have suffered infection from the poisonous matter drawn into it.

Our natural admiration for devotion carried to the point of self-sacrifice is apt to make us forget to ask whether the devotion might not better have been manifested in a more rational and equally effective way. In Dr. Sanford's case we think it might.

INTERNATIONAL EXCHANGE OF FOOD FISH.

While the German carp is being domesticated among us, converting our shallow fishless ponds into reservoirs of wholesome food, several useful fish of this country are being introduced into German waters. Recently 250,000 eggs of the delicious white fish of our great lakes were shipped by the U. S. Fish Commission to the German Fisheries Association, of Berlin. The eggs came from the United States hatcheries at Northville, Mich. The 700,000 eggs of the California salmon, shipped to Germany, France, Holland, and England some months ago, all arrived in good condition. Brook trout have also been sent to Germany, where they can scarcely fail to thrive. Germany has sent us the carp, in return, and also the golden ide, a beautiful and promising fish, which is under cultivation in the ponds of the Maryland Fish Commission.

It is expected that the Berlin Association will send, in addition to the species which have already been received from them, eggs of the saibling or charr, the large and handsome trout peculiar to the deep lakes of Northern Europe. It is highly esteemed as a food fish, and in Lake Constance it sometimes attains the weight of twenty-five pounds.

TEMPORARY DEAFNESS.

According to Dr. H. Augustus Wilson, a very common cause of deafness is the hardening of wax in the ear and the unscientific plan that people adopt for its removal. They generally succeed in making a bad matter worse. The ear is not so exquisitively sensitive to the presence of foreign matter as the eye, and hence those who work at the ear with hairpins and toothpicks are likely to injure themselves irre-

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parably. Only the softest materials and the gentlest pressure should be used in cleaning the ear. In a recent clinical lecture, the full report of which we give in the SCIENTIFIC AMERICAN SUPPLEMENT, Dr. Wilson gives, in popular form, some very useful and practical information touching the removal of ear-wax. If the ticking of a watch can be heard at a distance of 28 inches the hearing is good. Each ear should be tested by the watch separately. Noises in the head, sometimes ringing, frequently are due to hardened wax in the ear. Sudden deafness is sometimes caused as follows: A small mass of wax, from ill-health or uncleanliness, becomes hard. A continued secretion of wax then blocks up the ear tube still more. An injudicious attempt is then made to remove the wax by introducing, perhaps, a match end, a pin head, or a pen holder, which instead of removing pushes down the wax and packs it against the tympanum; or by a sudden draught or the act of swallowing the wax is suddenly pressed upon the membrane, and loss of hearing immediately ensues, because the membrane can no longer vibrate. The removal of the wax is in some cases, especially those of long standing, somewhat difficult; but with gentle treatment and patience may finally be accomplished and the hearing fully restored. The best ordinary means for removing wax, when not badly compacted, are half a drachm of sodium carbonate dissolved in an ounce of water, applied lightly, by means of a bit of absorbent cotton or sponge attached to a suitable handle. When the wax is much compacted it may be softened by means of water, quite warm, and a syringe.

A Remarkable Boiler Explosion.

The first explosion of a stationary boiler in this city, for a period of five or six years, occurred about midnight, December 17, under decidedly peculiar circumstances.

It was a new vertical tubular boiler, which had been tested within a year to 150 pounds, and was registered at 100 pounds. It was set upon a fire box of quarter inch iron, in a newly constructed brick boiler house, in the rear of No. 123 West Twenty-sixth street.

The engineer claims that when he left the boiler that evening the water was within a few inches of the top of the boiler, the fire was dying out, and, as he intended to build a fresh fire in the morning, he opened the furnace door and closed the damper and ash pan. Wood for kindling the next day's fire was in the boiler house. On going away he fastened the outer gate with a chain and padlock.

About midnight the neighborhood was startled by an explosion, and when an examination was made, the boiler-house was found to be wrecked and the boiler gone. Two hours later it was discovered in the rear of No. 441 Sixth Avenue, something like 200 feet from where it belonged. It was unbroken, and had fallen on end after its long flight over a number of tall buildings.

As the gate which the engineer locked was found to have been tampered with, and the kindling wood was missing, it was suspected that some one had taken refuge in the boiler house, or entered it maliciously, and had fired up, leaving the furnace doors closed on going away. The two steam gauges, which fell through a skylight two blocks away, registered 70 and 80 pounds respectively.

Coal Oil in Italy.

A Naples correspondent writes to a contemporary: "It is a noteworthy fact that mineral oil similar to that of Pennsylvania has lately been pumped in the Valley Cocco, in the Abruzzi, and also at Riva-Nazzano, near Voghera, in Piedmont, and it is believed that after a few more months' digging the oil springs themselves will be found. The American mode of extracting the oil is used, and some expert Canadians are employed on the work by an Italo-French company formed at Paris. The pumps are worked by steam, and the whistle of the engine is now heard where not long ago the shepherd's pipe was the only sound that broke the silence of the valley. As long ago as 1866 some Italians were ready to seek for petroleum in these localities, but were forced to desist from want of means. An illustrious geologist has asserted that there are many valleys in Italy rich in this oil, and several specimens of native petroleum exist in the geological cabinet of the museum at Milan. Companies are being formed to prosecute this industry, which must prove very profitable, for there is a tax of 50 per cent on the American oil, and expenses of transport equal to 20 per cent. If the Italians themselves do not enter into the speculation, it is certain that strangers will not be long in doing so."

Francis T. Buckland, well known in this country and in Europe as a writer on natural history, died at his home in London on December 19, 1880, at the age of 54. He was the eldest son of the Rev. William Buckland, D.D., Dean of Westminster. He was a student of Christ Church, Oxford, where he took his B.A. degree in 1848. He inherited a strong taste for natural history and physical science, and devoted himself to the study of medicine, and in 1854 became assistant surgeon to the 2d Light Guards, retiring in 1863. He was a voluminous contributor of papers on pisciculture and physical science to the London *Times* and our excellent contemporary *Land and Water*. At his own expense he established the "Museum of Economic Fish culture" at the Royal Horticultural Gardens, and did other things for which he was publicly thanked by the Royal College of Surgeons.

THE EXPANSION OF STEAM.

BY PROF. R. H. THURSTON.

In studying the actual performance of steam engines we have seen, as was stated in the reply to the question, "What is the proper point of cut-off in steam engines to give maximum economy in dollars and cents?" that the best point of cut-off is determined by so many and such variable conditions that we can only ascertain what is the best rate of expansion by experience with each class of engine.

The experiments made many years ago by the Navy Department on various kinds of marine sidewheel engines working at moderate speed and having unjacketed cylinders, the steam pressure being 25 to 30 pounds by gauge, proved the point of cut-off giving maximum economy to be at from four-tenths to five-tenths,* and such engines are still so worked.

With the higher piston speed customary with screw engines a little greater expansion may be attained. The irregularity of wheel which is due to short cut-off is one of the retarding elements which exists in less degree in the latter case though a serious drawback in the former, so serious that many engineers would hesitate to expand more than 2½ times even with steam at 30 to 40 pounds where the engine is of long stroke like our river beam engines.

In the case of the ordinary unjacketed stationary engine with drop cut-off and a speed of about 300 times the cube root of stroke measured in feet, the best examples that I have known have expanded about 3 times, neglecting clearance, when steam was carried at 40 or 50 pounds, as was common at their first introduction, 4 times when carrying steam at 60 to 70, and about 5 times with 100 pounds of steam. For such cases I should therefore be inclined to proportion engines, when designing them, to cut-off at about $\frac{1}{2}\sqrt{P}$.

With engines of *very* high piston speed, with engines of high speed and steam jacketed, and with compound engines in which the expansion is so divided as to reduce losses by internal condensation and to make the frictional resistances less, I should make the design such as would assume an expansion of about $\frac{3}{4}\sqrt{P}$. Thus the Porter-Allen engine, the pioneer of high speed engines, may, it is said, work with maximum economy at a cut-off of about one-eighth when steam is carried at 100 pounds per gauge. Yet an engineer of great experience, Mr. D. K. Clark, puts the point of maximum economy for the single cylinder jacketed engine with steam at 55 pounds at but one-fourth, the expansion ratio for the unjacketed engine with steam at 75 being put at 3.

The best figures for compound engines are about these:

Elder & Co.'s compound marine engine, with steam at 55 to 60, expanding 3½ times, and giving a horse power for a little less than 1¾ pounds coal per hour. (Donkin's stationary engines: steam, 50 to 55, coal, about 2 pounds expansion, 13½ times, and Leavitt's pumping engine: steam, 90; expansion, 13½ times; consuming 18 pounds steam—illustrate successful practice with greater expansion.)

United States steamer Bache (Emery's design); steam, 90 pounds; expansion, 7 times; using 20¼ pounds steam (or feed water) per horse power and per hour; and steamer Rush (same designer); steam, 82½; expanding 6¼ times; using 18½ pounds steam per horse power and per hour, are good cases.

In the latter case the designer concludes that it is of little advantage to carry steam pressure much above 100 pounds, and puts the economical points of cut-off at or more than one-fifth stroke for 80 pounds, and two-sevenths to one-quarter for the lower pressures used, and gives as a fair working rule for number of expansions $\frac{P \times 37}{22}$ for good single engines. He thinks this too high for ordinary engines and too low for compound, conclusions that it will be well to compare with my own.

Other such figures might be given, but these show that the best point of cut-off for engines constructed by the best builders is only known by actual experience, and is far within that which would give a terminal pressure equal to the back pressure line of the indicator diagram. Ignorance of this fact has caused the loss of many hundreds of thousands of dollars by builders and users of steam engines, who have vainly striven to secure economy of fuel by extreme expansion; and the loss due to too great expansion is usually greater than that caused by too little.

With increased piston speed and velocity of rotation, with increased efficiency of steam jackets and with increased dryness of steam, such as is obtained by superheating, we get nearer and nearer the ideal conditions of expansion, and no one can say where we may reach a final practical limit. We only know that progress is very slow in that direction, and we are still *very* far from the ideal limit.

My own conclusion is, therefore, as already stated, that engines, as they are built to-day by the best builders for marine or for mill work, with unjacketed cylinders and moderate piston speed, do their best work when expanding about one-half the square root of the steam pressure. Were I to choose the style of engine I should select the "compound" condensing engine for all work demanding very regular or very slow speed, and where a double engine has its special advantages, as in pumping or on shipboard; I would superheat moderately, steam jacket carefully—heads even more carefully than sides—and expand $\frac{3}{4}\sqrt{P}$ to $\sqrt{P}$, the latter at high speeds and with thin inserted cylinder barrel.

Where I could be confident of good work, and where a single engine might be allowable on other grounds, as in mills, I should probably select a high speed engine, steam jacket it completely, superheat 50° to 75° Fah., and expand $\frac{3}{4}\sqrt{P}$, using a condenser, where water could be had, whenever the engine was of moderate or large size.

Where compelled by limited means, or where the exceptionally low cost of fuel or other circumstances make it best to use the unjacketed cylinder and the less expensive forms of engine with drop cut-off, I would expand as in the first case above, $\frac{1}{2}\sqrt{P}$. And finally, if using the plain old-fashioned slide valve, I would set it to cut-off by the lap at three-fourths and raise the link in regular work so as to cut-off at about four-tenths or five-tenths, cushioning heavily and running fast. With that valve gear the limit is fixed, without reference to pressure, by the construction. High piston speed is of advantage in all cases where it can be adopted. Where the steam jacket becomes comparatively inefficient, as at very high rates of expansion, the remedy would be to design engines with thinner cylinders and heads, trusting to ribs for strength, and I should be inclined to use the inserted cylinder, as have some of the British makers for many years past.

The use of wrought iron or of brass cylinder linings properly secured would permit more rapid transfer of heat, and would in some cases, I have no doubt, prove of advantage. Non-conducting linings, as used by Smeaton and later by Emery could they be made to stand, would perhaps be still better.

As engines are actually built, every intelligent builder, if possessed of sufficient experience, knows pretty nearly what is the best point of cut-off for his engines, and is himself the best authority on that subject. The degree with which that point approximates to that found for a theoretically perfect set of conditions is also a true gauge of the value of his engine and all engines might be graded by this comparison. It is, perhaps, the best method of determining the economical value of any given *type* of engine under any given set of conditions.

* Clearance neglected.

Lecture Experiments.

COMBINING AND ILLUSTRATING THE GLOWING OF PLATINUM IN A CURRENT OF ILLUMINATING GAS WITH THE RENDERING LUMINOUS OF A BUNSEN BURNER FLAME, WHEN THE GAS IS PREVIOUSLY HEATED.

An ordinary Bunsen burner is increased in length to the extent of, say, 3 or 4 inches, by adapting a platinum tube to the upper end, of such a caliber as to snugly fit. On placing the latter in a horizontal position, and opening the cock, the ordinary flame is first obtained; thereupon, with another burner, the platinum tube is heated to bright redness, the non-luminous flame now becomes the ordinary luminous one. The change is most marked when the cock is not more than half open. Now remove the second burner and place the first upright; the platinum then begins to glow at the upper edge, which glowing soon passes down and extends nearly throughout its entire length. On closing the cock and opening, after incandescence has entirely ceased, it will again glow as before; this time, however, without flame at its extremity. C. GILBERT WHEELER.

Laboratory of the University of Chicago.

Propelling Boats Without Wheels or Screw.

Attempt has been made to propel boats on canals and rivers by conducting a column of water through a pipe and ejecting it forcibly at the stern, but it did not prove successful.

An Englishman now claims to have got over the difficulty by showing that "the force exerted by one fluid pouring into or against another depends on the contact of surfaces, and not on the sectional area of the flowing mass, after the flowing mass be once set in motion." Instead, therefore, of tubes with large orifice, he makes use of tubes with narrow outlet, a mere slit, and thus obtains a large superficial contact by ejecting water through a series of narrow openings.

New York to Philadelphia in One Hour.

The distance between New York and Philadelphia, in an air line, is 81 miles, over a comparatively level country. In a recent paper before the Franklin Institute, Mr. W. Barnet Le Van maintained that an air line road could be constructed between the two cities, on which trains could make the distance in one hour, and that the enterprise would pay. The line he proposed would cross no roads at grade, and would have but two curves of 10,000 feet radius each.

FOR articles of rubber which have become hard and brittle, Dr. Pol recommends the following treatment: Immerse the articles in a mixture of water of ammonia one part, and water two parts, for a time varying from a few minutes to an hour, according to the circumstances of the case. When the mixture has acted enough on the rubber it will be found to have recovered all its elasticity, smoothness, and softness.

CHIAN TURPENTINE IN CANCER.—At a recent meeting of the Medical Committee of the Middlesex Hospital, London, it was resolved that no more Chian turpentine should be ordered for the treatment of cancer, as, after a prolonged and careful trial, it had been found that its results were perfectly negative.—*Lancet.*

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Durability of Rails.

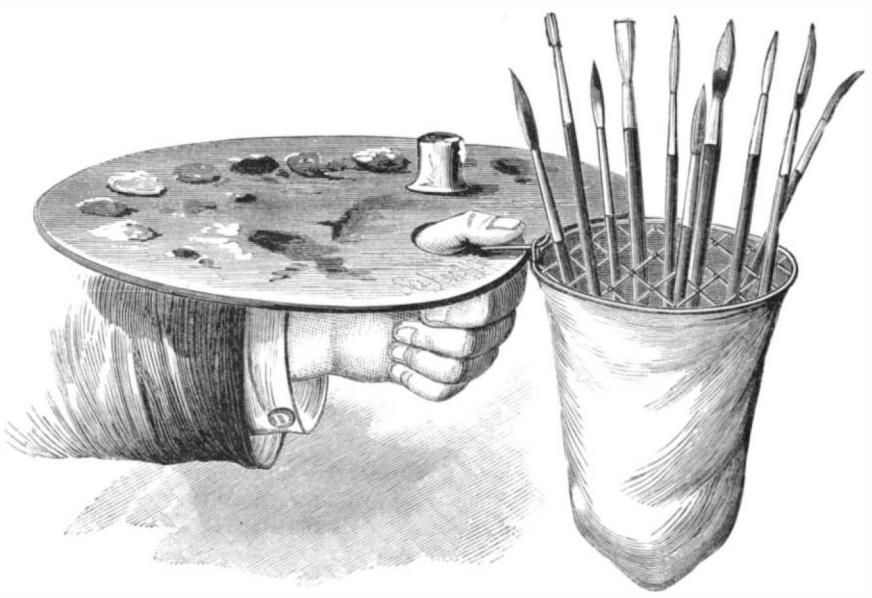
The tests of the durability of steel rails on the Great Northern Line of England, show that the hardest rails do not wear the best. In one instance a hard rail was worn away one-sixteenth of an inch by a traffic amounting to 5,251,000 tons. A softer rail near by was worn the same amount by 8,402,000 tons. In another instance the total was 15,531,000 tons for a hard rail, and 31,061,000 for a soft rail, the wear and tear being the same—one-sixteenth of an inch. Analysis showed this last rail to consist of 99·475 per cent of iron and minute quantities of carbon, phosphorus, silicon, manganese, sulphur, and copper.

BRUSH HOLDER.

The engraving shows a brush holder for sustaining and keeping the brushes used by an artist while painting separate from each other, particularly when the brushes are charged with paint.

Usually the brushes are held in the hand of the artist, and often with more or less difficulty; but with this device the handles are inserted through the grid and into the bag, the grid serving to keep the heads of the brushes apart from each other.

This invention was recently patented by Edith A. Pope, of Boston, Mass.



NOVEL BRUSH HOLDER.

The Safety of Steamboat Travel.

The annual report of the Supervising Inspector General of Steam Vessels corrects the prevailing impression that last summer was uncommonly prolific in steamboat disasters. There is charged against the year but twenty-six accidents involving loss of life, against thirty-two for the year before.

During the year the total number of vessels inspected was 4,536; total number of officers licensed, 16,661. The total number of lives lost by accidents from various causes was as follows: Explosions, 22; fire, 52; collisions, 66; snags, wrecks, and sinking, 14; accidental drowning, 25; miscellaneous casualties, 6; total lives lost, 185. The report concludes as follows: "I respectfully invite attention to the small percentage of lives lost as compared with former years, when the number of passengers carried was much less. Out of perhaps 220,000,000 passengers transported on steam vessels during the last twelve months—a daily average of over 600,000—but 185 lives have been lost through causes incidental to steamboat travel, 103 of which number were passengers; and I feel warranted in asserting that the fact that only one person was lost out of every 1,100,000 persons carried argues a degree of intelligence and skill on the part of the licensed officers of steam vessels and the officers of this service unsurpassed and scarcely equaled in any other service."

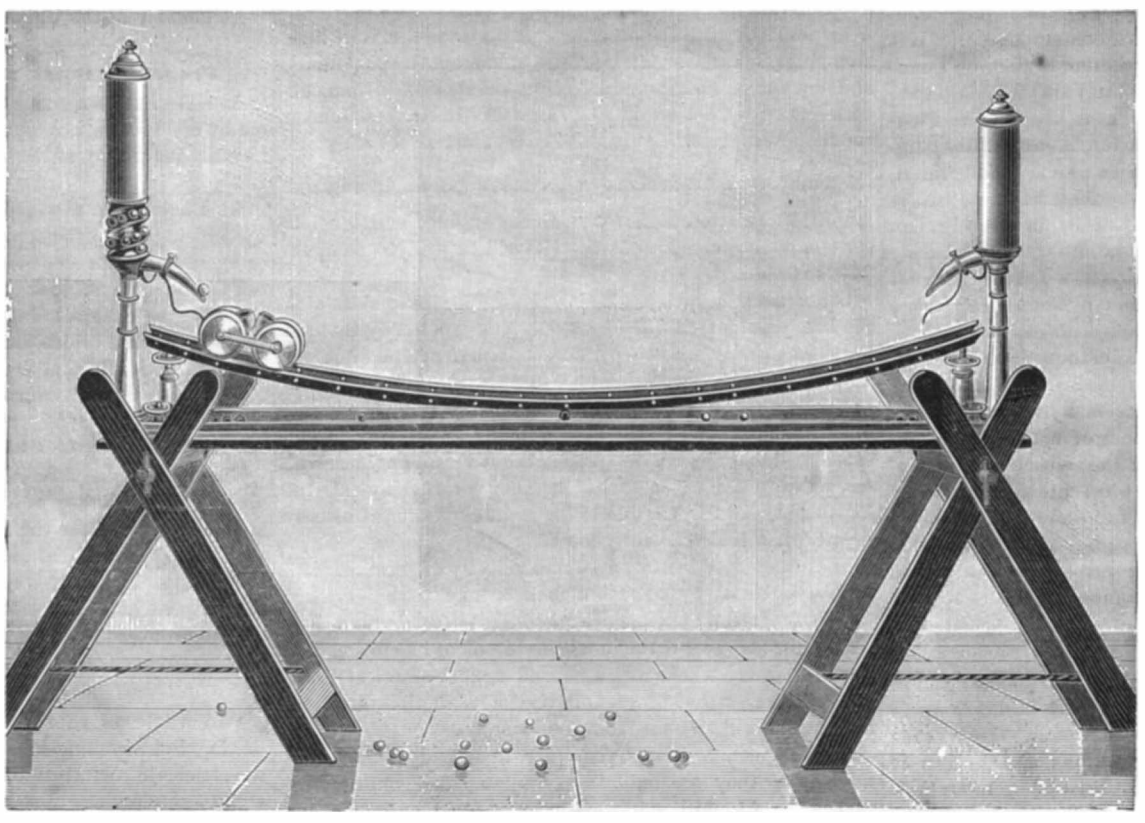
APPARATUS FOR DEMONSTRATING MECHANICAL PRINCIPLES.

An ingenious apparatus for demonstrating certain mechanical principles is shown in the accompanying engraving from *La Nature*. It is the invention of Mr. Jean Mocenigo. The curved track is about five feet long. The car carries two shallow cups designed to catch and discharge small balls of lead or other material dropped from the cylindrical reservoirs at the ends of the track.

When set free at one end of the track the car by itself descends to the bottom of the curve and is carried by its momentum part way up the opposite slope; then it returns, and continues the to-and-fro motion until brought to rest at the bottom by the combined resistance of friction and the air. The amount of this resistance is measured by means of the balls employed to keep up the oscillation of the car.

The discharge of the balls is effected by the impact of the car upon the light springs underneath the spouts at the ends of the track, one and only one ball being let go at a time. The car thus loaded runs to the bottom of the curve, where the ball is dropped, the increased momentum from the added weight just sufficing to carry the empty car to the summit of the other slope and set free another ball, by which its gravity is re-enforced for another excursion. In this way the to-and-fro movement of the car may be maintained for any length of time.

It is obvious that in one complete excursion of the car the force applied is equal to the combined weight of car and ball falling through a distance equal to the height of the end of the track above the middle; the work done is equal to the lifting of the car alone through the same distance, the ends of the track being on the same level. The difference between the power and the effect is the measure of the power consumed in overcoming friction, the resistance of the air, and the force of the spring by which the ball is discharged.



MOCENIGO'S APPARATUS.

Atlantic Cables.

The lengths of the several cables between the United States and Europe and their locations are given as follows: The three Anglo-American cables now in use run from Ireland to Newfoundland, 1,850 miles, and from Newfoundland to Sydney, over 300 miles—a total distance of about 2,150 miles each; the Anglo-French cable from Brest to Duxbury, by way of St. Pierre, is about 3,329 miles long; the Direct United States cable from Ireland to Torbay, and from Torbay to Rye Beach, 2,360 miles; and the new French cable from Brest to Louisburg, 2,430 miles, from St. Pierre to Cape Cod, 880 miles, and from Brest to Penzance, 151 miles—a total length of about 3,461 miles.

Preparations are being made for laying two new cables to be operated in connection with the land lines of the American Union Telegraph Company. They will connect with the land lines at Cape Breton, and be about 2,400 miles long.

Of the cables laid by the Anglo-American Company, the one put down in 1865 was broken March 11, 1873, and finally abandoned February 1, 1878; that laid in 1866 was broken January 13, 1877, and abandoned July 27, 1878. The latter cable, except the shore ends, was renewed last summer at a cost of £222,300; it is now called the cable of 1880. The cable laid in 1873 was broken April 2, 1879, and was repaired in the same month; it is now in operation. No break has yet occurred in the cable laid in 1874. Of the three cables now working, which were laid by the company, one has been down over six years and another over seven years. The Erlanger cable, under the management of the Anglo-American Company, was laid in 1869; it was broken in the following May, and several times since the same accident has occurred. It was last repaired in August, 1879, having been broken February 22 in that year, but it was again broken last month. It is said that the cable is so rotten that no attempt to repair it will again be made.

The cable of the Direct United States Company was laid in 1874, and has been broken twice: the first time, January 4, 1879, on the ocean side near Torbay, and in February, 1879, in the Rye Beach and Torbay section. Both breaks were repaired, and the cable is said to be now in good condition. The cable of the new French Company has been down about a year. It was broken May 2, 1880, near the Island of St. Pierre, and repaired the same month; the section between Cape Cod and St. Pierre was broken November 21, 1880, and is now repairing.

ENGINEERING INVENTIONS.

An improved car coupling has been patented by Mr. William I. Ely, of Freehold, N J. The invention consists of an open-mouthed and open top draw bar, having pivoted within it a spring-actuated hook-headed jointed coupling bar, and of the combination therewith of a stirrup fitted within the draw bar, embracing or set about the coupling bar.

Mr. John W. Carley, of Cotton Gin, Tex., has patented an improved machine for boring wells, prospecting, and mining shafts, post holes, and various other purposes where earth is to be loosened and removed. It is so constructed as to operate continuously, except while sections are being added to the shaft and belt, the earth being removed as fast as it is loosened.

Mr. John G. Herold, of Moberly, Mo., has patented an improved nut lock for railroad rail joints, by which the nuts are prevented from becoming loose and dropping by the jar of the engines and cars passing over the rails; and the invention consists of a flanged locking strip or piece with beveled underside that is fitted into the angle of the fish bar. The flange extends up between the fish bar and inner face of the nuts into the space formed by the interposed washers of the nuts, while the top of the locking strip in front of the flange is notched below the nuts for retaining the corners.

An improvement in surveying instruments has been patented by Mr. Thomas M. Jackson, of Clarksburg, West Va. The invention consists in attaching a level detachably to the body of the telescope of a plain transit instrument by means of two armed or hinged clamps whose upper or free ends are secured together by thumb and binding screws, the telescope being also provided with laterally projecting pins that indicate the proper position of the clamps and prevent it from shifting.

An improvement in baling presses has been patented by Mr. William Duke, of Longtown, Miss. The invention consists in constructing a rotating baling press with plates and rollers interposed between its friction surfaces to diminish the friction when the press is operated.

An improvement in that class of railway car trucks in which the brakes are not applied to the flanged running wheels, but to small wheels which are mounted on the axle between the truck or running wheels, has been patented by Mr. George Bressler, of Altoona, Pa.

An improved vehicle wheel has been patented by Mr. John Ladner, of Charlestown, Mass. The invention consists in constructing a vehicle wheel with friction rollers placed in a countersink in the hub, a ring oil chamber having holes in its inner wall, the plates that close the outer end of the hub, and the guard plate attached to the inner end of the hub, whereby the friction is lessened, the bearing kept lubricated, and the escape of oil and the entrance of dust are prevented.

An improved drilling machine for artesian and other wells has been patented by Mr. Patrick Sweeney, of Leadville, Colorado. The invention consists of a drum for the drill rope loosely mounted on a shaft and provided with a rising curved flange on each end and with two studs on one end, the studs engaging with a cross bar on the shaft, and the rising flanges sliding on adjustable projections of the frame, thus causing the drum to move forward and backward on the shaft, whereby it is alternately engaged with and disengaged from the cross bar, thus raising the drill and then permitting it to drop.

An improved drilling machine for artesian oil wells has been patented by Mr. Frank Knowlan, of New York city.

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The construction and operation of this machine cannot be clearly described without engravings.

An improved rub-iron for car trucks has been patented by Mr. David E. Small, of York, Pa. The object of this invention is to provide an ordinary car truck with an improved rub-iron which will adapt the truck to carry either wide or narrow car bodies, or such bodies as are used upon broad or narrow gauge roads, so that the car body, with its cargo, may be transferred from the truck of a wide gauge to the truck of a narrow gauge road.

Volcanic Thunder Storms.

A paper on volcanic thunder storms, by M. Faye, was read before the French Academy of Sciences, on November 2. It is stated that in paroxysmal eruptions the enormous amount of steam ejected causes volcanic thunder storms, which are very different from ordinary thunder storms. The volcanic storm has no gyratory movement; it is confined to the column of ascending clouds, and no flashes occur without the presence of ashes. Altogether, the phenomena resemble very closely those of the Armstrong electric machine. As observers have failed to mention any hail attending these thunder storms, it is probably because no hail is formed. Its absence is due, M. Faye thinks, to the lack of gyratory motion already noticed.

TIDAL OUTLETS FOR SEWERS.

On this page we show a plan from Mr. Rawlinson's "Suggestions" for a main sewer outlet to the sea, or to a tidal estuary on a flat shore.

The object sought to be attained by this plan is to permit the rise and fall of the tide in such a manner as not to disturb the flow of sewage, or drive back sewer gases during windy weather or during the rising of the tides.

In Mr. Rawlinson's plan, the sewer is much smaller than many outlet sewers, being oviform, 3 x 2 feet, with an area of 4·594 square feet, equivalent to a circle of 1·654 feet diameter.

The main is carried to a man hole chamber, at which a flap valve is placed over the inlet. There are two outlets, one from the bottom by an 18-inch cast iron pipe, leading to a point below low water, and terminating in a bell-shaped end opening downward, the other from the high water level by a 24 inch pipe of cast iron, so constructed as to discharge between high and low water mark.

The man-hole chamber is ventilated at the top.

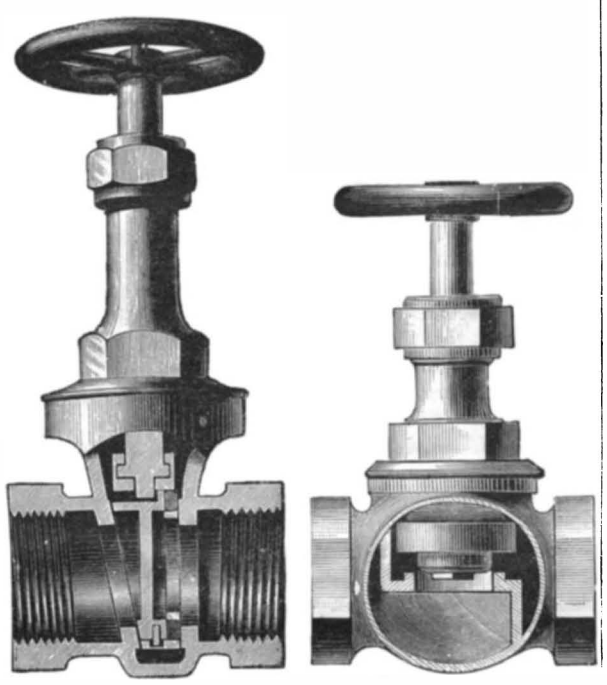
At some distance back from the chamber an 18-inch cast iron pipe is led from the bottom of the sewer to the bottom of the man-hole chamber, which is above low water mark. It is there trapped, so as to prevent the passage of air if the pipe is not running full.

This pipe is intended to carry off the dry weather flow of the sewer without opening the flap at the chamber inlet, and thus allowing the entrance of wind from the outlet. A ventilated man-hole is placed over the upper end of the pipe.

This is, upon the whole, a neat arrangement. Its chief defect, if it can be called a defect, is in the reliance upon a flap valve. All automatic appliances are rather unsafe in a sewer, being liable to be clogged and their action impeded by the slime and foreign material, which cannot be prevented from entering the sewer. In this case the flap seems altogether useless, for the flood-water overflow, which is the only inlet for wind at the seaward end, might just as well be carried to low water level, and seated in the same manner as the low water outlet.—*The Plumber and Sanitary Engineer.*

JENKINS' PACKING AND VALVES.

The engraving shows two forms of valve patented by the late Nathaniel Jenkins, and now a well known standard article familiar to manufacturers and steam engineers throughout the country. These valves are provided with disks of Jenkins' compressible packing instead of the usual metallic surface. This packing has been in every-day use for twelve years, and has been indorsed by first-class engineers and mechanics throughout the country. It is found to



JENKINS' IMPROVED VALVES.

render the valve perfectly tight under all pressures of steam, oil, or gas, and it is not injured by sand or grit, nor will foreign substances lodged between the valve and seat prevent it from closing.

Should it become necessary to repair one of these valves it need not be removed from its place, as the disk can be replaced in a few minutes, at a small cost, and without the aid of a mechanic. No regrinding is required as in other valves.

The improved packing is applied to various purposes, and is largely used by our best engineers and manufacturers. It is made up in sheets, gaskets, rings, and washers, and when used in a joint subjected to steam or heat it hardens, forming a body which, the manufacturers claim, will last for years, as it does not burn out or decay, and if care is taken, the joints may be often broken without injury to the packing. The same material is also made up into pump valves, which, we are informed, have given general satisfaction, being especially desirable on account of its heat-resisting qualities It is used in pumps for handling oils and acids, and may be used where rubber valves have failed, a special form of the packing made which is adapted to valve stems rendering the stuffing boxes steam and water tight.

Messrs. Jenkins Brothers, of No. 11 Dey street, New York city, and 104 Sudbury street, Boston, may be addressed for further information in regard to these inventions.

AGRICULTURAL INVENTIONS.

Mr. William H. Ryer, of La Crosse, Wis., has patented an improvement in sulky plows. This invention consists in the mechanism for raising and lowering the plow upon the frame, and in certain other features of construction, which cannot be described without engravings.

Mr. George W Fink, of Pleasant Plains, Ill., has patented an improvement in that class of check row seed planters in which the seed-dropping mechanism is actuated by a rope stretched across the field; and has for its object to simplify the construction, lessen the weight, and increase the reliability of the seed-dropping mechanism.

A combined listing plow and seed planter, patented by Messrs. Leonard A. Cooper and Oliver F. Bostwick, of Atchison, Kan., is so constructed as to open the ridge or clear a space for the row of hills, open a furrow to receive the seed, drop the seed, cover the seed, and roll down the soil.

Messrs. Richard E. Caviness and George McCormick, of Beckwith, Iowa, have patented a check-row corn planter of the kind that is operated to drop the seed by a line stretched across the field.

An improved cockle mill, for separating cockle and other small seeds from wheat, has been patented by Mr. James M. King, of Walnut Station, Minn. It is simple in construction and effective in operation.

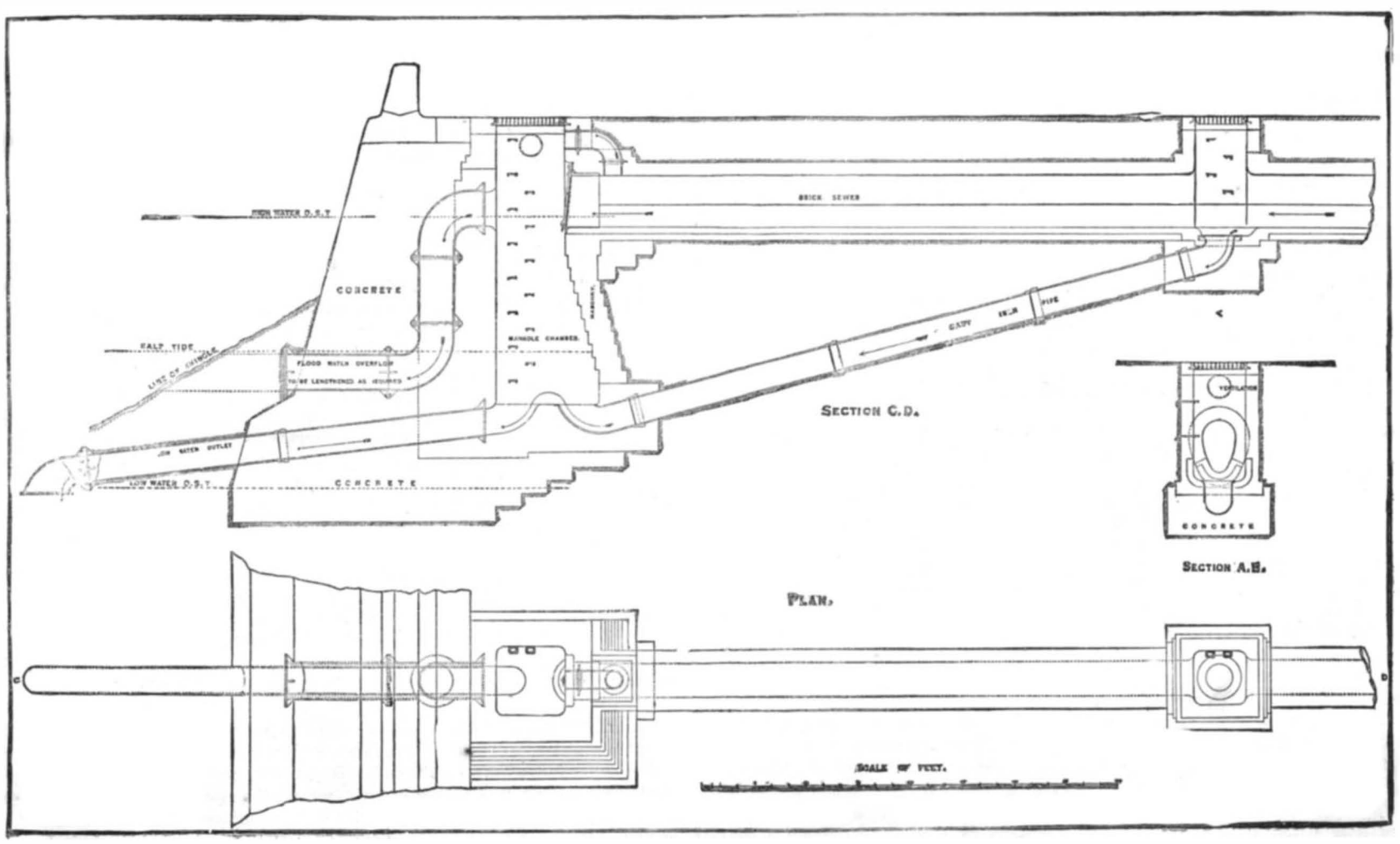
Mr. George C. Winslow, of Kalamazoo, Mich., has patented an improved harrow and cultivator tooth which is not only yielding to obstructions, but one capable of adjustment for greater or less tension, as well as adjustable to greater or less depth and inclination.

The "Frigate" Mackerel.

A notable event in the history of our coast fisheries was the sudden appearance, last summer, of the "frigate" mackerel in immense schools about Block Island and the adjacent waters. These fish are very common about the Bermudas, the Azores, and on the coast of Europe, but were never before seen in the waters of the United States. It was estimated that many of the schools in the vicinity of Block Island contained from 80,000 to 100,000 fish each. Considerable quantities of the fish were taken, but they were found in small demand as a table fish. They will probably prove valuable chiefly for the oil which they contain, and for use as a fertilizer.

Beatty's Organ Factory.

In another column of this week's issue we publish a new advertisement from the Hon. Daniel F. Beatty, Mayor of Washington, New Jersey, the well known manufacturer of the Beatty organ. An appropriate gift for a holiday present would be one of his 14 stops $65 organs. Mr. Beatty extends a cordial invitation to all who desire to purchase either a piano or an organ to visit his manufactory at Washington, New Jersey. Every organ he sells he makes in his own factory. Read his advertisement and send for his holiday newspaper and catalogue, which he sends out free.



SEWER OUTLET ON TIDAL RIVER OR SEA SHORE.

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THE ALBION COAL MINES.

BY H. C. HOVEY.

The series of startling disasters by which these famous mines have lately been overwhelmed with loss, and perhaps with utter ruin, serves to recall a memorable visit I made to these same collieries only three months ago. They are worth describing, independently of the painful interest awakened by recent distressing events.

The Albion Mines are located in Pictou County, in the province of Nova Scotia, about 100 miles north of Halifax, and one mile from the village of Stellarton. The entire coal field of the province, so far as explored, occupies an area of about 685 square miles; but the portion lying in Pictou County is a basin by itself, irregular in form, inclosed by much older geological formations, and covers only some 35 square miles. Although thus limited in extent, as compared with other fields, it possesses great value on account of the extraordinary thickness of its beds. According to Hon. Mr. Gilpin, Inspector of Mines for Nova Scotia, to whom I am indebted for much of my information, as well as for personal attentions, the section of measures in the district of the Albion Mines has a vertical thickness of 2,450 feet, holding 100 feet of coal, lying at an angle of 18 degrees.

The group on the western side of East River exists in several seams of varying thickness and quality. Those most extensively worked are known as the deep seam, which is reached by the "Cage Pit," and the main seam, pierced by the "Foord Pit." The deep seam is nearly 23 feet thick; the main seam actually attains the enormous thickness of 35 feet, although the portion worked does not exceed 22 feet. I was conducted to a spot where the workmen had cut through the entire seam and had taken out a section 35 feet high for exhibition in the Provincial House at Halifax, where I afterward had opportunity to verify the statement by actual measurement. For 22 feet it is clear coal, without a particle of foreign material that I could discover; and the balance has only here and there an intruding stratum of slate or clay.

It should be stated that all the coal thus far found in Nova Scotia is of the bituminous variety; no anthracite having yet been discovered. It has much firmness, however, and though burning freely does not readily slack or crumble. These qualities make it a favorite steam coal on the Atlantic and other steamers. It has also been extensively used for domestic purposes, and it is admirably suitable for coking. Large quantities were formerly exported to the United States for gas making. Analyses made by the London Gas Company, in 1879, gave 10,300 cubic feet of candle power gas, and 14 cwt. 2 qrs. of good coke per ton of coal. The gas is also represented as remarkably free from sulphur and other deleterious ingredients, when the purifiers were attended to.

These mines were formerly owned by the General Mining Association, of England, which also owned other mines in the Provinces; but a few years ago they sold out to what is known as the Halifax Mining Company, chiefly, however, London capitalists. The Acadia Company, working what is regarded as an extension of the main seam at Westville, is the only American company in the region. Some idea of the importance of this field may be had from the official statement that the area of the Halifax Company alone contains 67,365,000 tons of available coal. The entire coal produce of Nova Scotia for 1879 was reported to be 788,271 tons; of which aggregate the Albion Mines produced 171,534 tons, being a larger quantity than was taken that year from any other single mine in the Dominion. In the year 1862 the yield was about 200,000 tons, and the current year promised to exceed even that showing. The company, under the able management of Superintendent James Hudson, has a line of steamers of their own, and were filling large orders in Montreal and elsewhere. With the improvements recently made, a daily extraction of 500 tons had been reached from the Foord Pit alone, besides what came up from the Cage Pit; and other enterprises were under contract that would operate to increase even this very large yield. Several fine engines had been sent over from England, just prior to my visit, the design of which was to introduce compressed air as a substitute for horse power on the underground railways. To facilitate work further the principal inclines had been regraded. In fine, everything pertaining to the mines was in as perfect order as human ingenuity could compass; and the terrible disaster that now has wrought such havoc was wholly unexpected.

The upper works of the Cage Pit present nothing of unusual interest; but after descending a shaft 300 feet deep, one is led to the head of a wonderful inclined plane, half a mile long, up and down which cars are drawn by a steel rope. The rope itself is a heavy load to be hauled up many times a day, without taking into consideration the string of cars full of coal. Another curiosity that the foreman took some pride in exhibiting was the system of lighting the portion of the mine near the engine. This was done by utilizing a natural supply of gas flowing from a crevice in the wall. I asked the question, if there was not a degree of danger attending this; but was reassured on being told that the gas was thoroughly headed up in a reservoir, and that those very jets had been burning *seven years*. Yet when tidings came of the explosions in and flames issuing from the neighboring pit, it occurred to me that such a steady stream of gas as I saw must proceed from a hidden and dangerous source. Undoubtedly it was so, though there may have been no immediate connection between those pretty jets and that destructive conflagration.

Before entering the Foord Pit I gave some time to an examination of the works above ground. In doing so I had the company of Mr. Gilpin and Mr. Joseph Hudson (the son of the superintendent). They showed me the old engine "Hercules," the first locomotive run on any railroad in British America. It was still in use; and the man who ran it on its trial trip, so long ago, is still employed by the company. A duplicate engine of the same age, called the "Samson," stood on a side track near by, in good repair and daily use. In proximity to these antiquated affairs was one of the latest and most highly improved English locomotives; the contrast furnishing an instructive object lesson in the progress of modern mechanism.

We found the patriarchal engineer himself at his post of duty in the pump house, running the gigantic steam pump by whose powerful strokes a volume of water is continually discharged as large as a man's body. The buckets, about two feet in diameter, are brought up in three successive lifts of a little more than 300 feet each, making 1,000 feet in all. At the time of my visit the water from the old workings had been nearly exhausted, and the great pump was relied on to raise the water from both the main and deep seams. Who could then foresee the bursting in of a flood in September, from an old and long disused pit, and another on the 12th of October, drowning six men besides several horses? Or that later explosion of fire-damp, making it necessary to pour *into* the mine all the water that could be obtained? This pump was at that time considered equal to all emergencies that might arise.

The ventilating fan, of the Guibal pattern, having, I believe, a diameter of 30 feet and a width of 10, was in a building by itself, and was run by steam acting on a crank turning the fan at the rate of 40 revolutions a minute, with a capacity of 50 or more, and drawing from 65,000 to 70,000 cubic feet of air from the mine. So strong was the suction that ingress to the fan house could be had only through an air-lock. The object was twofold, to withdraw inflammable gases from the pit, and to supply the men working there with fresh air. The Cage Pit is ventilated by a furnace. The atmosphere, as we afterward ascertained, is kept as pure as could be desired by either method under ordinary circumstances.

The actual conveyance of the current thus forced underground to the places where it is most needed is by shutting off the old passages not now worked by brattices or thin partitions toward the working faces, and in many cases by air-proof cloth curtains hung in such a manner as to guide the current, even to the extent of splitting it and making the subcurrents travel in opposite directions. But, as recent events have shown, the best precautions cannot prevent the sudden release, at times, of hidden magazines of explosive material stored up in the coal, which by superior force overpower the ventilation, and, as in the Albion disaster, destroy the fan itself, hurling its fragments to a distance and demolishing the building covering it.

The original method of entering the mine was, of course, by the inclined plane, through which the horses are still let in; but the drawing arrangements of the colliery at present are clustered around a pit, and the coal is drawn to the surface in cages. The cage is an open framework of steel bars holding a double deck, two trams being carried on each deck. It is raised by a steel rope fastened to the top bar; and while one cage is lifted another is lowered. The cages are guided by vertical rails to hold them steady in passage.

The loaded cars are run from the cage on to a wide platform, where they are first weighed, then dumped and returned. The steel rope is 6 inches in circumference and 1,200 feet in length. It runs over a drum 22 feet in diameter, revolving at a rate wholly under the control of the engineer. Entering an empty cage with Mr. Hudson, we were let down the vertical shaft, 1,000 feet in 70 seconds, and found ourselves among the swarthy miners. The number employed varies according to circumstances. The published statement in 1879 showed the number at work underground to be 384, of whom 84 were boys; there were 200 surface workers, of whom 37 were boys; a total of 584 employes. The horses used were 38 below and 17 above. The cutters numbered 259, and the average per cutter per annum was 662 tons of coal.

Those whom we conversed with seemed contented, and said that they made a comfortable living, getting from $1.25 to $1.75 per day, besides rent and fuel at greatly reduced rates. They surprised me by their intelligence, of which there was at least one ready explanation, viz., they were, many of them, faithful readers of the SCIENTIFIC AMERICAN; and some of the very men who have since met a terrible fate spoke most warmly of the pleasure and profit they derived from its contents.

A few feet from the bottom of the shaft is the lamp cabin, where stood Mr. William Dunbar, a man 70 years of age, who for 40 years had been a miner, and during most of that long period had been responsible for the safety lamps. He explained to me the improvements made in the old-fashioned Davy lamps, whereby the gauze is protected by a glass cylinder from being overheated, and the construction is such that when the air is dangerously charged with gas, the light is infallibly extinguished. As an additional precaution each lamp is locked when given out, so that a careless workman cannot get at the blaze to light his pipe, or for any other purpose. When Mr. Dunbar handed me my lamp he was in fine health, and boasted that mining agreed with him well. It pains me to see it stated that the fine old man is among the victims. He was in his cabin as usual, at the time of the explosion, dealing out lamps to the men, when the flames burst in at his back door. He rushed out the front door and fell on his face. His oil-soaked garments instantly caught fire, and though by his own efforts and the aid of others he finally extinguished them, it was not until he was so badly burned as to be beyond recovery.

My guide and I traveled around in the mine for what he said was about six miles; finding, of course, considerable sameness of scenery, yet seeing many things novel to one more used to exploring natural caverns than such artificial excavations. My main anxiety was to keep from being run over by the horses which went at full trot through the darkness as fearlessly as if above ground. Their stables were below, but extensive and comfortable; and the horses were seldom taken to the surface, except in case of sickness, till they died. At the time of the explosion 17 horses were found dead in their stalls. Suffice it to say that our trip was without accident.

The only indication of the presence of deleterious gas observed by us was an occasional hissing sound, like the singing of a teakettle, caused, as we perceived, by leakage of gas through fissures in the seam, but not in quantity sufficient to make an explosive mixture before being carried off by the current of ventilation. Everything seemed as safe as could be desired. No serious accident has occurred since the great fire of 1861, when the East River had to be turned into the mine to extinguish the flames.

In order to an understanding of the late calamity, some idea should be given of the method of working the field. The entire excavation, judging from the official survey I saw in the possession of Mr. Hudson, must equal 100 miles; and the tramways alone extend for about 20 miles. There is also an underground connection between the Foord Pit and the Cage Pit, as a workman told me who had gone through it. Most of these workings are now abandoned and closed up by masonry. The system adopted is a form of pillar-working, ribs of solid coal being left between the "bords," or openings at right angles with the main or gate level; and these again are intersected by bords parallel to the main level. The result when spread on a chart looks like an irregular checker-board. The side passages are usually at a steep slope from the main level, and advantage is taken of this to arrange for delivering the coal to the tramways by a system of counter balances, the full cars as they run down carrying the empty ones up to the place where the coal is being cut. The pillars vary from 16 to 18 feet in thickness, and the bords are about 20 feet wide; hence it is evident that, as mining proceeds, only about one-half the coal in the field is removed, the remainder being left as a support for the roof. The custom of "robbing the mine" has not here been introduced; by which is meant taking out the pillars, one at a time, and letting the roof fall to the floor. The practice is attended with some danger, and also shuts off access to portions of the field lying beyond the passages thus closed.

The Foord Pit is divided into the north and the south stope; the one to the north extending for a mile and three-quarters, and the south stope for more than a mile, numerous bords being worked in each. The explosion of November 12 took place in the south portion, at half-past six o'clock A.M., when 150 men had just begun their day's labor. At first it was supposed that this entire number had been destroyed; but those in the north stope escaped uninjured, and the number of the lost as last reported was thought not to exceed 50 men and boys, of whom, however, 33 are married men.

The first to volunteer to explore the mine was Mr. Joseph Hudson, who, together with Mr. Tupper, overman, and Messrs. Poole, Greene, and others from the Acadia and Vale collieries, ventured in for a quarter of a mile, four hours after the explosion. They found the stoppings on the south side blown off, and did something to facilitate ventilation, but peril from accumulating gas was too great to allow of their remaining more than two hours or so, and they came to the surface at noon to await further developments. At the same time the men at work in the north stope came up to dinner and learned the fate of their companions.

The alarm spread until the mines were stopped in all Pictou County, and the people came in crowds about the pit. Attempts to flood the mine during the day were made, and many thought the danger over. But at 10 P.M. an explosion more violent than ever shook the ground, tore off the roof of the fan house, and the descending fragments riddled the roofs of adjacent buildings. The report was heard a long distance. This was followed by another explosion at 2 A.M., and similar outbursts were repeated at intervals till the ruin of the mine seemed inevitable. Volumes of smoke poured forth from the shafts, showing what a conflagration was raging below. Fire engines from Pictou and New Glasgow were brought and set to pumping water into the shafts. Men were set to work to fill the main shaft with spruce boughs, clay sods, hay, etc., to stop the air from the mine; and for the same purpose the shafts of the Cage Pit were closed up, and orifices into old mines in the vicinity. A trench was opened from East River to the fan shaft, through which it was hoped to extinguish the subterranean fires.

No one seems to know how the fire originated, though several theories have been suggested. In Mr. Gilpin's report on the Department of Mines for 1879, he gave a warning note to increase the systematic ventilation of the collieries, and not to reason that "because fire-damp is present only in traces a very slight circulation of air is all that is required." He also points out the defects of the kinds of

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safety-lamps in general use. But the mystery of the calamity at the Albion Mines is that every precaution imaginable seems to have been taken, and all the machinery made after the best patterns, and yet in vain. The deposit of coal is too valuable to be abandoned, being one of the finest in the world, and it is probable that at some time operations will be resumed. But it is certain that this cannot be done for a long time to come.

Meanwhile there are left to the charity of the public, it is said, "33 widows, 110 orphans, and 700 men, representing a population of 2,000 people, thrown out of employment in the face of a Canadian winter." An appeal on their behalf has been sent out by the managers of Nova Scotia mines, clergymen, and others. The case is certainly one that calls for an immediate and generous expression of popular sympathy.

AMERICAN INDUSTRIES.—No. 64.

THE MANUFACTURE OF BOLTS AND NUTS.

Perhaps there is no other one cause so potential for the cheapening of production nowadays as the minute division of labor carried out in every leading branch of manufacture. And the cost of making is not only thereby greatly reduced, but the quality of the product is improved in yet greater proportion. The industry which forms the subject of the first page illustrations in this paper affords a conspicuous example of this course of development in modern manufactures. There is hardly a large manufacturing establishment or a respectable machine shop in the country which has not the available facilities for forging bolts, turning screws, or making nuts, yet it is comparatively seldom that one of either of these is made by the mechanics who put them in their machines or the manufacturers who use them in a thousand different articles of which they form an indispensable part. The reason is obvious: the manufacturer who has constituted this his especial business can not only make them far better than an ordinary mechanic, but so much cheaper that it seems like wasting time to do even trifling work of this kind in a general machine shop, the ready-made bolts and nuts being of such uniform good quality that a flaw or a weak spot can rarely be found in them, and of almost every desired size required for use in all kinds of work.

It is now nearly forty years since two of the present proprietors of the great bolt and nut factory of Russell, Burdsall & Ward, commenced business in this line, at a point on the Byram river just within the Connecticut State line, about two miles from the village of Port Chester, N. Y., and twenty-five miles from New York city. The site selected was one of romantic beauty, in a picturesquely wooded dell, but their location here was for the purpose of utilizing the water power which over forty feet fall in the Byram river afforded. The contrast between their business of thirty-five years ago and its extent to-day is well illustrated by the two views, which show their factory as it was then and is now. Then one horse and wagon was sufficient for the bringing of all their iron and the shipping of all their products from Port Chester, and every detail of the work not only received the personal attention of the proprietors, but the most important portions were the results of their own skill and handicraft. Even greater, however, than the difference in the amount of business, is the contrast between the way of making bolts and nuts at the commencement of their manufacture and that which is followed to-day, the many elaborate machines now used producing results which were hardly imagined possible at that day, and a large proportion of these machines, either in all their parts or in important improvements, being the invention of members of the firm.

The iron used is received in the form of bars or rods, both square and round, and in great hanks or coils, a large stock being always kept on hand. Iron only is worked here, and a considerable proportion of the goods are made from the best charcoal iron. In the main bolt making room, shown at the bottom of the page, there is probably as great a variety of machines for making bolts, and the capacity for as large a production, as can be found in any single establishment in the world. Nearly all the iron is worked cold, an improvement which has, within a few years past, been finding steadily increased favor, from the great additional strength which this manner of working gives to the goods, as against the former method of making all the blanks by the old-fashioned method of forging. Care is necessary, of course, that a bar of cold iron be not submitted to too many manipulations, but there is never any danger of this kind in the methodical operations of bolt making, where every blow the iron receives, and every time it is to be submitted to pressure, are accurately determined before the commencement of the work. The increase in strength in bolts, from working the metal cold, is estimated at between 50 and 100 per cent, and the effect in general is to give the iron a good deal of the qualities of hard steel.

For this cold working, however, powerful machines are necessary, as every portion of the labor of forming the iron is done by them, the labor of the hands being confined almost exclusively to the feeding of the machines. There are different patterns of machines here for doing the same work, but in the making of a blank for a bolt, either the wire or rod is fed into the machine so as to pass between a pair of feed rolls, which hold the metal by friction, and convey it into a steel tube or die in the central part of the machine, where the length of the bolt is accurately determined by an adjustable gauge, and is cut off in lengths sufficient to allow enough surplus metal for the forming of the pattern of head the bolt is to receive. As it is cut off it is grasped between fingers and carried to the opposite end of the die, where it is pushed back into a hole having the form of the bolt head, where a hammer strikes it and forces the surplus stock into the desired shape, after which the blank is driven from the die and drops into a box beneath.

When these blanks so headed are of square iron, they are taken to another machine, where they are suspended by their heads in a long row, between two parallel tines, from which they feed themselves into the machine, where they are grasped, one at a time, by fingers, and each one is held between the jaws of powerful revolving cam formers, being advanced and withdrawn three or four times, until the square iron is perfectly rounded, either entirely up to the head or so as to leave a square shank. The fingers then drop the rounded blank to one side, and, reaching back, pick up another one, to go through the same operation, the whole process impressing one with the idea that the machine is almost possessed of reasoning powers, so careful, deliberate, and intelligent seems to be its imitation of the motions which a workman would go through in performing a similar part of the work.

The forming of the point and the cutting of the thread are done by other machines, in which are the same feeding device and similar automatic working, these operations, however, sometimes requiring two machines, while for some goods only one operation is necessary. When the blank is fed into the jaws, which seize the end bearing the head, it is advanced against a tool which forms the point, if that part is to be completed here, and, this work being done, the blank is then passed to a chasing tool, which cuts the thread as in an engine lathe, varying the number of cuts to the size and the amount of metal to be removed. This machine, as also the blank formers and headers, are so arranged as to guard against accidents as completely as if they were possessed of intelligence. If any one part ceases to operate, or to properly fulfill its functions, the machines will stop of themselves, or have self-adjusting contrivances to remedy the difficulty; if the blanks are too long or too short they cannot be worked, and if too great strain is brought on any part, from any displacement of the machinery or the introduction of foreign matter, the machine stops and makes a noise readily distinguished from that caused by regular working.

The above describes the main features of all the bolt-making machines, although, from the great variety of goods made here, no less than from the many improvements which have been successively introduced by the firm, there are many differences in the details of the operations in swaging and finishing. All of the work, however, is performed by machines which work automatically, and some of the machines here for forming particular patterns of bolts are different from those in use anywhere else. The firm have a large machine shop, in which they make their own machinery, and besides several patents which Mr. Ward has obtained, they have made other improvements, not patented, more especially valuable in the making of goods of which they have the almost exclusive production.

In the nut-forging shop, represented in one of the illustrations, the bars are heated, the workman keeping one bar in the forge fire while he feeds the heated end of another into the jaws of a machine which cuts off the required length and punches it, while at the same time the nut is formed by hammers striking it rapidly on the bottom, top, and sides, to compress the metal and give the nuts the desired shape. This machine works very rapidly, and the goods are certain to be perfectly uniform in quality and shape, whether the nuts are square, hexagonal, or any other form.

The packing room, represented in one of the views, occupies a large department, for here are put up in paper boxes each day no less than 125,000 bolts and nuts of the smaller sizes, the larger ones being generally shipped in bulk. This work is done principally by girls, who, in long practice, acquire a degree of manual dexterity in this part of the work which is surprising to any one who has not previously noted the results of such training.

It would be impossible to enumerate, in anything less than an elaborate catalogue, the number of different kinds and patterns of bolts and nuts made at this establishment. Every standard article in this line forms a part of their regular production, in all the lengths and sizes ordinarily used. A large business has been done from the first in carriage, tire, and sleigh bolts of every description known to the trade; stove bolts are made in large quantities; plow bolts are an important specialty, and bolts for mowing machines, cultivators, and elevators, with nearly all kinds of machine bolts, knob screws, etc., are a portion of the staple goods regularly manufactured. Besides these, however, the firm do a large business in the making of special sizes and lengths, to order, for use in particular departments of manufacture, their long experience, and the high quality of their goods, which it has always been their first care to maintain, giving them special advantages for filling the large trade of this kind which comes to them.

The Library Hall is a building erected by the firm for the purpose of affording their employes better opportunities of self-culture. It contains a choicely selected library of about 2,000 volumes, and the scientific portion of the books were chosen by Prof. Youmans with especial reference to the needs of such a class of working readers. There is here, also, a warmed and lighted room, intended to make a comfortable place in which the hands can profitably and pleasantly pass their spare hours. No intoxicating liquors are to be had within two miles of the establishment, and it is the design of the proprietors to make the surroundings of those who live in the immediate neighborhood, and who earn their living there, so pleasant that there will never be any call from their hands for a place where liquor can be bought.

The firm have no city warehouse, but do all their business from the factory at Port Chester, N. Y., where the partners reside and give their personal attention unremittingly to the work of the establishment.

DECISIONS RELATING TO PATENTS.

Supreme Court of the United States.

BALL *et al. vs.* LANGLES *et al.*

1. Reissued letters patent No. 4,026, granted to Hosea Ball, June 14, 1870, for an improvement in ovens, declared to be invalid, it being for a different invention from that covered by the original patent.

2. The Commissioner of Patents is invested by law with authority to determine whether surrendered patents are invalid by reason of defective or insufficient specifications or by reason of the patentee's claiming as his own invention or discovery more than he had a right to claim as new, and whether these errors have arisen by inadvertence, accident, or mistake, and without fraudulent intention. His decision as to the existence of these prerequisites is conclusive, and not subject to review by the courts.

3. The Commissioner, however, has no authority to grant a reissue embracing new matter or a broader invention than what was revealed in the original specifications, drawings, or models.

4. The question of identity of invention is to be determined by an inspection of the two instruments.

5. Where an original patent described an interior baking chamber as provided with perforations in its sides and back, whereby its interior had communication with the fire space only *indirectly* through side and back flues, *Held*, that a reissue removing the restriction as to the location of the perforations, so that the interior of the chamber may communicate *directly* or *indirectly* with the fire space, is void for containing a different invention.

Appeal from the Circuit Court of the United States for the District of Louisiana.

Mr. Justice Strong delivered the opinion of the court.

We cannot doubt, says the court, that the purpose of the reissue was not to cure defects in the original specification, or any deficiency in describing the invention, but to cover other devices which the patentee had not in mind when he first applied for his patent, and which may have subsequently come to his knowledge. Thirteen years after the patent was granted had elapsed before he applied for any reissue. However this may be, the reissued letters are so clearly for a different invention from that for which the patentee first applied, containing new matter, and so much broader, that we are constrained to hold that the Commissioner of Patents had no authority to grant them, and consequently that they are void.

The complainants' bill was, therefore, rightly dismissed, and the decree of the court below is affirmed, with costs.

Large Telegraph Wires.

At the recent meeting of the American Electrical Society in Chicago, Col. C. H. Wilson read a paper on the use of large telegraph wires. He held that the employment of large gauge wires for the quadruplex circuit was an advantage. A No. 4 wire recently laid between New York and St. Louis, was giving entire satisfaction. The question had been raised whether, in the desire to increase the conductivity of the wires, there was any limit to their size. There was a limit, and the conductivity could be increased by employing different conductors, copper instead of iron wire, for instance.

In a discussion which followed, Mr. Somers advocated the use of large wires, and said that their employment had simplified the quadruplex problem.

Phosphor Bronze Telegraph Wires.

M. E. Bède, formerly Professor at the Liége University, has recommended the use of phosphor bronze for wires instead of iron, phosphor bronze having four times the conductibility of iron, and being from three to four times as strong as steel. Aerial lines had the advantage of being easily inspected, but the disadvantage of being liable to accident, while underground lines were almost free from accident, but difficult of inspection. That inventor would render great service to telephonic communication who should devise a cheap method of constructing underground lines, that should at the same time permit of easy and complete inspection.

Lard Butter.

The success of butter made from beef fat (oleomargarine butter) has led to the use in Chicago of pork fat or lard for the same purpose. It has been reported that large quantities of this fraudulent butter have been shipped to England, seriously injuring the market for genuine American butter. The report is disputed by exporters, though it is admitted that sample lots have been sent by New York and Chicago dealers. Obviously if lard butter is wholesome and of good flavor it can be sold on its merits; if bad it should not be sold at all. In either case its sale as genuine butter would be a fraud and should be prevented.

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IMPROVED HAND AND BENCH VISE.

The tool shown in the annexed engraving is especially adapted to the use of mechanics, inventors, jewelers, and amateurs, and it may be either used as a hand vise or bench vise. The jaws may be thrown by a single movement into any desired angle. As a chuck for the lathe or bit stock, it will hold drills, awls, bits, turning tools, etc. It may also be used as a wrench which is capable of being turned in any position. Pattern makers and metal workers will find it very convenient for holding scrapers, stubs of files, and cutting tools.

The front jaw has a tubular stock at right angles to the face of the jaw; in this the bar of the back jaw slides, and is prevented from turning by a slot and feather. The screw that moves the jaws turns in the tubular stock. A clamping eye surrounds the stock, and receives a screw which presses against a follower in the eye, and clamps the stock in any position in which it may be placed in the clamping eye. The clamping screw is forged in one piece, with the ferrule at the end of the handle by which the vise is held. The clamping stand, by means of which the vise is secured to a bench, is shown in Fig. 3.

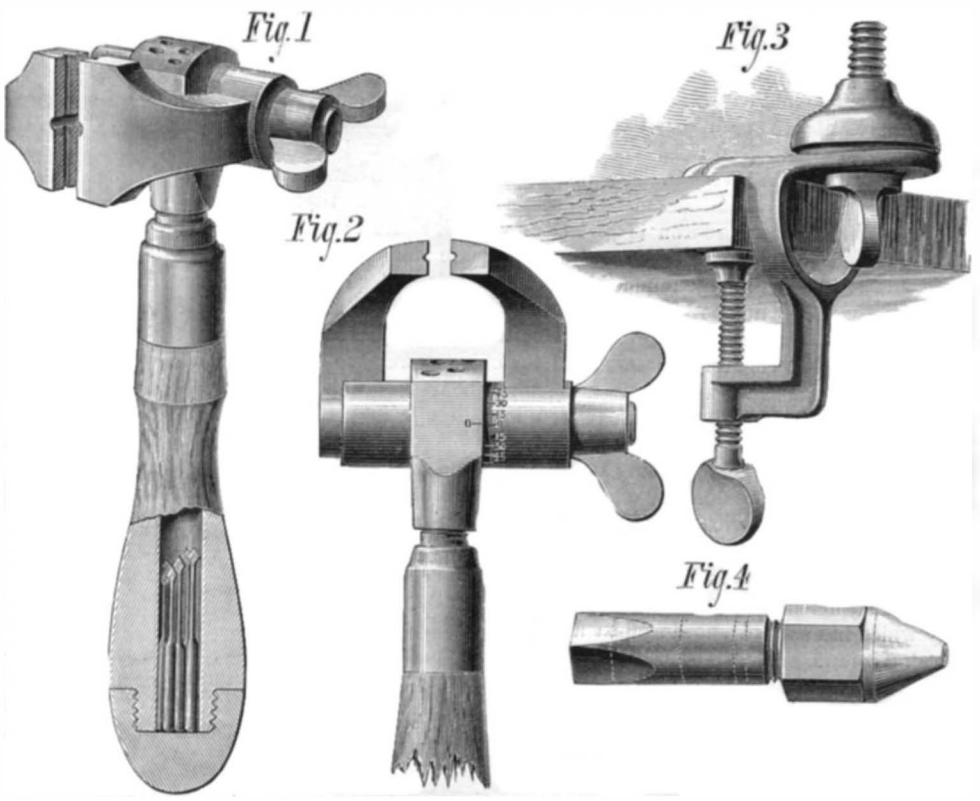
In either instance the vise can be made to hold any article that is to be filed, turned, bored, or otherwise worked, or the jaw may be used to hold any cutting or boring tool or bits, so that this tool is of general utility, especially upon all sorts of tool or hand work.

The cavities or countersinks in the clamping eye will receive the inner end of a boring bit or tool, the body being held by the jaws of the vise, and the tool, when used as a chuck in a lathe, can be arranged in line with the axis of motion or at an angle, as may be required, and will perforate, bore, or turn the interior or exterior of a cylinder or other article of greater or less diameter, according to the angle of the tool and its length. Graduations on the tubular stock and clamping eye indicate the angle of the one to the other. The jaws can be quickly and accurately adjusted to any degree of angle required, either above or below the center, right or left, and made ready for work by a quarter turn of the handle.

The solid forged ferrule of the handle of the vise is bored to receive the shank of a drill, and the addition of the drill chuck shown in Fig. 4 makes it a complete drill holder. The shank shown in connection with the drill chuck, in Fig. 4, adapts the device to a common bit brace or lathe, and the same shank may be applied to the vise for heavier work.

All of the parts of the vise are of steel, drop-forged, and milled. It is well made, substantial, and durable.

This useful tool is made and sold by Mr. B. F. Stephens, 95 and 97 Liberty street, New York city.



B. F. STEPHENS' SOLID STEEL HAND AND BENCH VISE.

IMPROVED AWNING AND VENTILATOR.

The novel window awning shown in the engraving is capable of being readily put into various positions to shade the window and to effect a proper circulation of air in the apartments.

Window awnings, as commonly made, are only capable of shading the window, and as they are closed at the top it makes an effective funnel for drawing into the room heated air from the building and pavements and foul air from the street and gutter, without affording any means of exit.

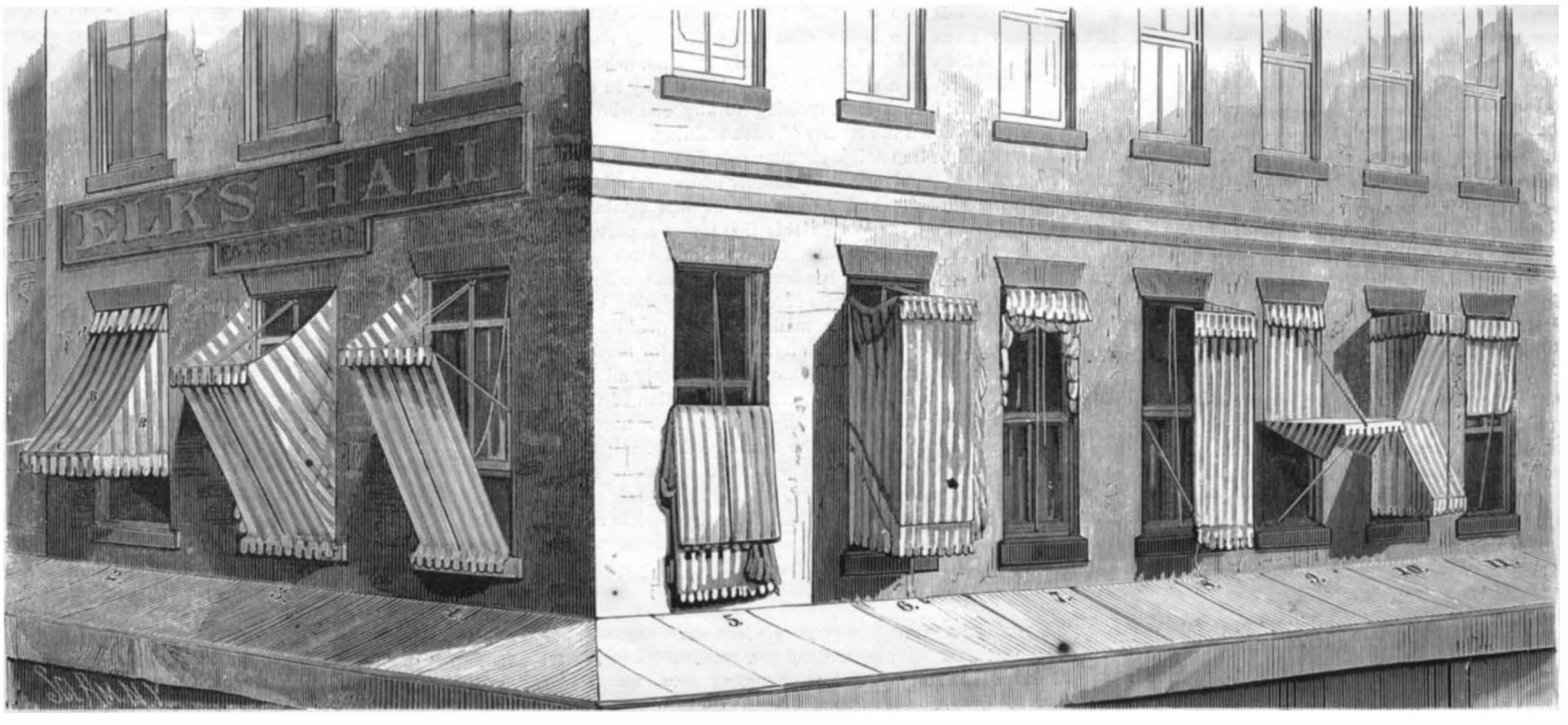
The frame, A, of the improved awning, shown in Fig. 1, consists of the upper and lower bent bars, *a b*, pivoted together at their ends, and secured to the window frame by means of thumb screws, *c*. The awning cover, B, is attached at its upper and lower ends to the bars, *a* and *b*, and at its lateral edges to the window frame by buttons or rings. This construction practically divides the awning into two sections, *d e*, either of which can be opened or closed, as may be required. The only difference between the old frame and the new one is. that the latter has two bars instead of one, and is attached to the middle of the window frame instead of the lower quarter. The new awning also has an extra cord and pulley, and requires a little more canvas than the old style, but this is more than compensated for by the readiness with which it may be applied to a window, no fitting, cutting, or nailing being required, and the inventor states that when the durability of this awning is considered it is much cheaper than the common form.

Fig. 1.

The various ways in which this awning may be arranged are shown in the annexed engraving, which is taken from a photograph, and accurately represents the invention as applied to the building at the corner of Gay and Baltimore streets, Baltimore, Md.

Fig. 2 shows the old style of awning with improvements attached. Fig. 3 shows an adjustment made by loosening a central cord, opening the top, and closing the bottom, placing the awning in an inverted position. Fig. 4 shows the awning having one of its sides dropped on its inner surface. With this arrangement, when the wind blows along the side of the building, it is gathered and directed into the room. Its action in this case is similar to that of a wind sail used on vessels at sea. Fig. 5 shows the upper half of the window exposed; the reverse of this is shown in Fig. 11. Fig. 6 shows an arrangement that is often desirable, especially after the awning has been rained upon, as it allows air to pass around its entire surface, drying it rapidly, and thus avoiding mildew and decay. The awning, when drawn up into small compass, is shown in Fig. 7. It may, in the same manner, be drawn down and secured at the bottom. These positions render the awning perfectly secure against any wind storm. In Fig. 8 both sides of the awning are dropped on its inner surface. This arrangement is desirable in many ways, especially when the awning is used on the south side of a business street, as it will effectually protect the eyes from light reflected from the buildings opposite. Fig. 9 shows a desirable arrangement when the sun is at or near the meridian. The central cord, in this case, is fastened on the outside of the awning. Besides the arrangements shown in the engraving, the awning may be placed in eight other positions.

In devising this awning the inventor takes advantage of the tendency of heated air to rise and of cooled air to descend. The awning, when inverted, permits the foul air to escape from the room, and allows the descending column of cooler air to enter the room, thus equalizing the temperature, so that there is but two or three degrees difference between the internal and external air. The inventor has proved the efficiency of the awning when thus arranged, not only in thoroughly ventilating and cooling the apartment, but also in excluding the noxious vapors that rise from the street and gutter at night. The great advantage possessed by this awning over others, in this respect, will be apparent without explanation. It is also effectual in excluding



DR. DWINELLE'S WINDOW AWNING AND ROOM VENTILATOR.

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dust during wind storms while permitting of perfect ventilation.

The inventor says that by the aid of these room "ventilators" every bed-chamber can be made a sanitarium during summer epidemics.

The germs of diseases, animal and vegetable parasites, fungi, albuminoid ammonia, etc., which are swept from the streets and gutters by servants into the air and carried into our sleeping rooms for hours before our waking, will find an effectual check by the use of these inverted "awnings," rendering us many times less liable to sickness, for it is a well known fact among physicians that persons are more liable to take disease during their sleep.

These room ventilators are so constructed that their entire surface can be brought under the immediate inspection of the eye, and within reach of the brush and cleaner. By drawing up the lower part of it and letting the upper bar fall through the lower one, the canvas is turned inside out, bringing its upper outer surface close to the window, where it may be freed from dust, spots, or stains, and cleaned with suitable washes for preserving its colors and making it last three times as long as the old style awnings, which are nailed securely to the top and sides of window fames, putting all of the outer surface of canvas beyond the reach of any protection, and which, too, after it has been rained upon, though the sun may shine for days and dry its outer surface, the space between the awning and upper sash is filled with choke damp air, containing minute fungi, causing the cloth to mildew and decay in a short time, also emitting noxious odors into the room, which is familiar to every one who has had much experience with the common style window awnings. As these "ventilators" are reversible, they can be readily turned inside out, and they may be used in that condition after the outer surface has faded or worn seedy.

A number of letters recommending this invention very highly have been shown us by the inventor; among them we notice one from Dr. James A. Stewart, Health Commissioner of Baltimore, an authority in medical and sanitary science, and another from Mr. George A. Frederick, a well-known architect of Baltimore.

It is needless to refer to the further advantages of this useful invention, as they will be apparent to any one having had experience in the window awnings or ventilators of the ordinary kind. This is a simple device that combines both in a very effective manner.

These improvements were patented August 24, 1880, by Dr. James E. Dwinelle, southeast corner Broadway and Baltimore St., Baltimore, Md., who may be addressed for further information.

A Spinal Root of the Optic Nerve.

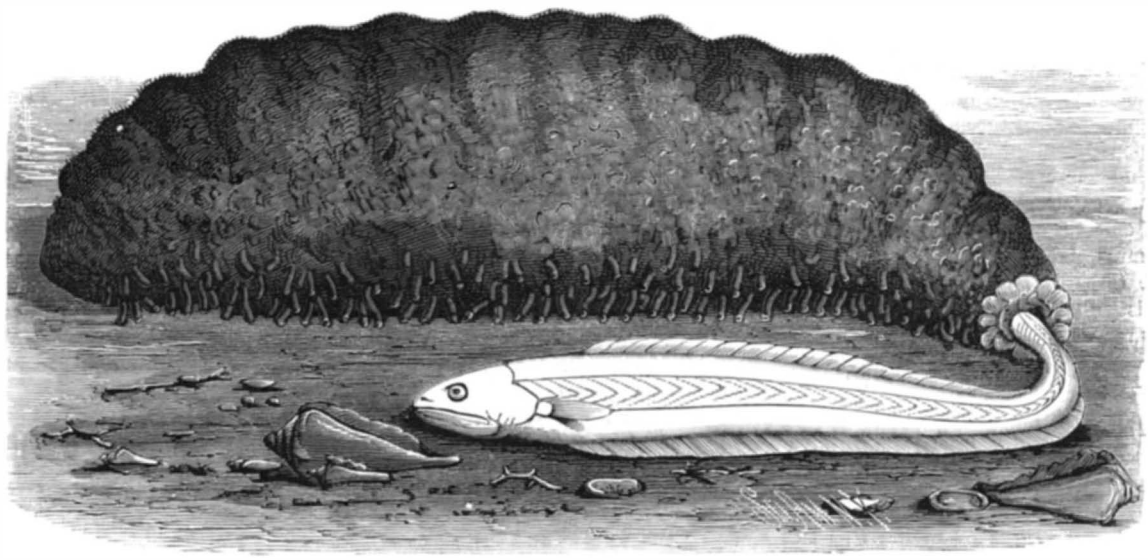
Stilling of Strasburg showed preparations to the International Ophthalmological Congress, at Mailand, in Septem ber last, which he believes demonstrate the existence of a spinal root of the optic nerve, which brings the retina into direct connection with the medulla. This root passes from the external corpus geniculatum, in a winding course, deep between the bundles of the crus cerebri, and can be traced into the pons; and it appears to course down in the direction of the medulla, although its further progress cannot be demonstrated.

The existence of this branch is interesting on account of the light it throws on certain physiological relations between the medulla and the retinæ, and may constitute the hitherto undiscovered link between certain diseases of the spinal cord and of the optic nerve.

A STRANGE PARASITIC FISH.

BY C. F. HOLDER.

Among the marine parasites we find several fishes whose peculiar methods in the struggle for existence are worthy of being recorded; one is the fierasfer, found by the writer in the Bêche de Mer, and the other the attendant of the physalia. Between Bird, Long, and Garden Keys, of the Tortugas group, a large shallow reef sweeps away to the south, fringed on the outside with breakers and a submerged wall of dead coral and other *dêbris* washed up from time to time.

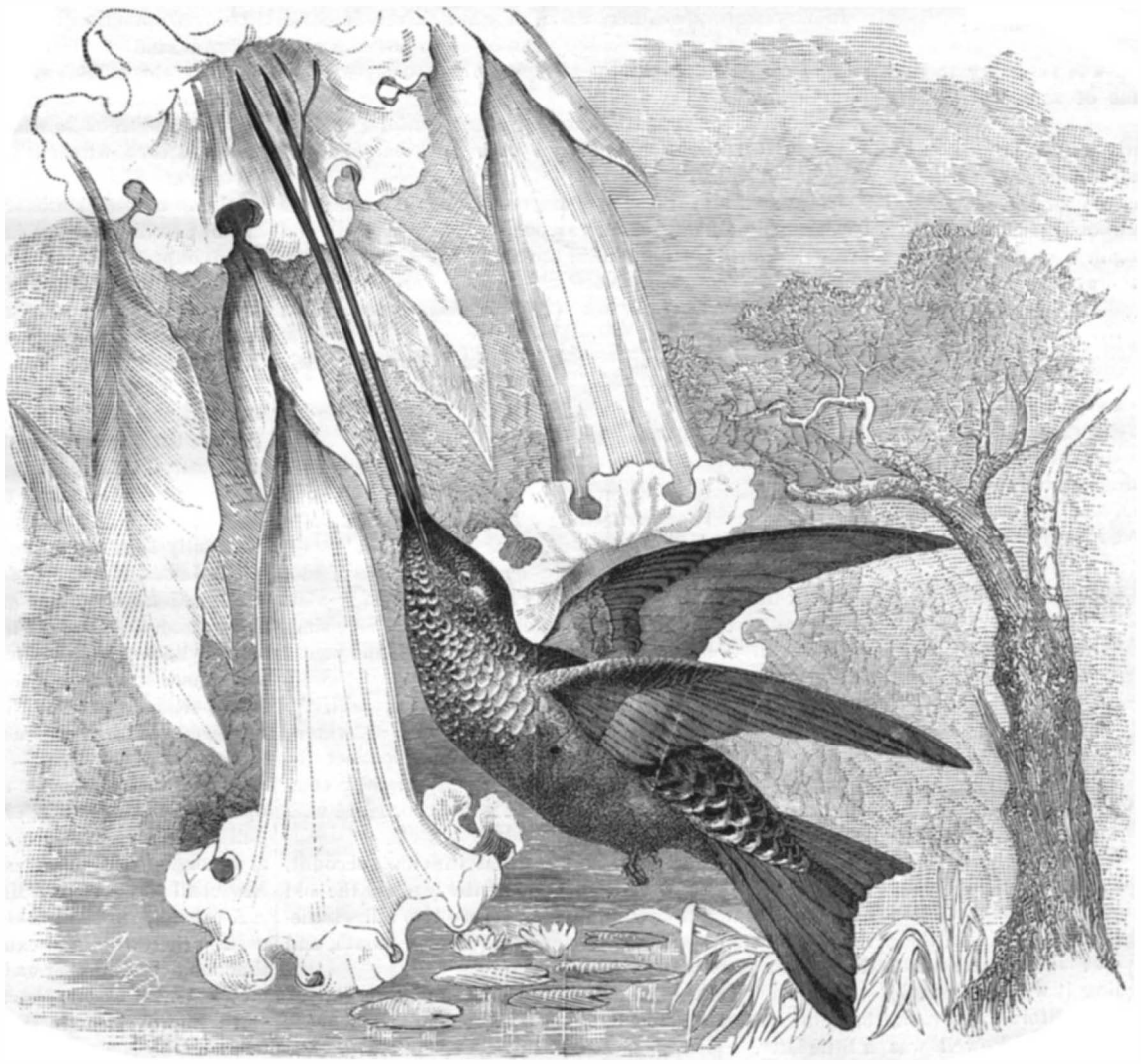


PARASITE FISH.

The clear water within is rarely over four feet deep, some portions being pure white sandy bottom, while other parts are overgrown with large tracts of coral, astreas, meandrina, etc. Here is the collector's paradise. Among the huge heads of meandrina, numerous rare and beautiful fishes move lazily about. The branch coral swarms with radiates and crustaceans, while the sandy bottom and clear water are peopled severally with hordes of creatures adapted for their various surroundings. In drifting over these submarine gardens, new features appear at every step, and with a small coral hook and a pair of grains, enough specimens can be collected in a day to stock a large museum. The most common objects on the bottom are the large black echinus and the bêche de mer. The latter here attain their largest size, and their worm-like forms are seen stretched out in various positions. While drifting over this reef we came upon an extremely large specimen; jumping over, we lifted it from the bottom, and were about to throw it into the boat when our attention was attracted by the end of a fish protruding from the mouth of the holothurian. Holding it over a glass jar in the boat, we saw a long, silvery, eel-like fish gradually squirm out of his mouth. It dropped into the water, and after several attempts to swim, sank to the bottom, and shortly died. It was about eight inches long, tapering down to the tail, and in color clearly resembling the fishes from the Mammoth Cave. A delicate dorsal fin extended the entire length of its back, and its whole appearance was eel-like. Suspecting that the fish was a phenomenal parasitic occurrence, we collected other holothurians, and in many of them, after cutting open the thick skin, found the same fish, and in every case it died when exposed to the open water, showing conclusively that it could not live out of the stomach of its protector. Careful examination of the reef, covering a period of eight or nine years, failed to show one of these fishes in any other condition than the above, and its habits, methods of increase, all are as much an enigma as have been some of the habits of our common eel. The fish, doubtless, takes its position in the holothurian when young, and either feeds upon the entrails of the animal or upon the food it takes in; either conditions are possible, as the holothurian, if deprived of a part of its internal machinery, every day could easily reproduce it, and would probably offer no objection, as we have frequently seen them disgorge their entire internal system, and reproduce a new set.

The holothurian in which this fish is found has for its specific name *Floridana*, and is a large dark-brown sea cucumber, with the feet scattered irregularly over the body, and with smaller tentacles than in *Pentacta* of our northern coast. The alimentary canal is often found filled with pieces of shell, corals, etc. It is about three times as long as the body, with longitudinal small folds, and held in place by a large, broad mesentery, which accompanies the intestine throughout the greater part of its length, terminating suddenly in a cæcum much larger than that of the above-mentioned species. In this canal lies snugly ensconced the fierasfer, now feeding on the pieces of coral or mollusca taken in by its host, or in default of this, tearing and lacerating the sides of its self-constituted prison. Its entrance into the alimentary canal of the cucumber may be attended with some danger, as the pharynx of the *Floridana* is calcareous, while in *Pentacta* it is muscular. Another species is found inhabiting the star fish (*Culcita.*)

Concerning the methods of reproduction of these animals nothing is known, and the fact that those observed by the writer died upon escaping from the holothurian makes the question still more enigmatical. They undoubtedly seek the protection of the holothurian instinctively when young, and a curious example of quasi-reasoning power in low organisms is evidently shown. The Rev. J. H. Murphy, in his work entitled "Habit and Intelligence," seems to regard instinct as the sum of inherited habits, remarking that "reason differs from instinct only in being conscious. Instinct is unconscious reason, and reason is conscious instinct."



SWORDBILL HUMMING BIRD—(*Docimaster ensiferus.*)

THE SWORD BILL HUMMING BIRD.*

This humming bird derives its name from the singular shape and size of its beak, which is very nearly as long as the rest of the body.

This curious species is rather large, as it measures about eight inches in length. It inhabits Santa Fe de Bogóta, the Caraccas, and Quito, and is generally found at considerable elevations, having been often seen at a height of twelve thousand feet above the level of the sea. The inordinately long bill is given to this bird in order to enable it to obtain its food from the very long pendent corollas of the brugmansiæ, and, while probing the flowers with its beak, it suspends itself in the

* Wood's Natural History.

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air with a tremulous movement of the wings. Its movements are singularly elegant, and while engaged in feeding it performs the most graceful maneuvers as it probes the pendent blossoms, searching to their inmost depths. The nest of this species is hung to the end of a twig, to which it is woven with marvelous skill, and its whole construction is very beautiful.

The adult male bird is colored as follows: The head and the upper part of the body are green, glossed with gold in some parts and with bronze in others, the tints changing according to the light. The wings are dark black-brown with a purple gloss, and the tail is dark black, bronzed on the upper surface. Behind each eye is a small but conspicuous white spot slightly elongated, and there is a broad crescent-shaped mark of light green on each side of the neck. The under parts are of a bronze green, and the under tail coverts are flecked with a little white. The female is of much the same color as the male upon the upper parts of the body, except that there is a little white upon the lower part of the back and a narrow white line behind the eye. The throat is brown, each feather being slightly edged with gray, and there is a very faint indication of emerald green on part of the throat. The young male is much like the female, but is more coppery in his hues. The throat is white, speckled with brown, because each feather is white with a brown tip. At each side of the throat there is a large patch of green intermingled with white.

Correspondence.

Colored Lights in Parlor Theatricals.

To the Editor of the Scientific American:

Having occasion to assist in getting up a series of tableaux, considerable difficulty was encountered in securing a satisfactory light. Living at some distance from New York, a calcium light was difficult to procure, and, moreover, too expensive. The use of gas and reflectors had been suggested. Procuring two 14 inch glass reflectors, I experimented with gas, with poor success. While the amount of light reflected was unsatisfactory, the interposition of a sheet of colored glass, or even a film of gelatine, sensibly diminished its volume.

Compelled to fall back on colored fires, I constructed a furnace of tin at small expense, that succeeded beyond expectation. A tin cylinder, 18 inches in diameter, was opened out at the side to admit a pane of glass, 16 x 24 inches. This glass, fastened securely in its place, constituted one side of the box, the curved inner surface of bright tin served as a reflector. A sheet iron bottom and an 8 inch heater pipe, leading from the top of the cylinder out through a convenient window into the open air, completed the apparatus. At the back of the box was constructed a sliding door large enough to freely admit the hand and closing tightly.

The peculiarity of the apparatus was:

1st. The large smoke pipe which was necessary to conduct rapidly away the large volume of smoke generated; and,

2d. The box was made as nearly as possible *air tight.* The chlorate of potash furnished all the oxygen necessary for combustion, and all the air necessary for draught was admitted through the slide door, which could be closed quickly upon any indication of a back draught.

The following formula for red fire gave the best results:

Powdered nitrate of strontia	8 ounces.
Powdered chlorate of potash	4 "
Shellac in coarse powder	2 "
Lycopodium	¼ ounce.

This mixture burns slowly, gives a good light, contains no sulphur, and can be prepared by any druggist.

By placing the fire in tin troughs, 8 or 10 inches long, the amount of light and length of burning can be regulated to a nicety, and by alternating red, blue, and green in the same trough, these colors can be exhibited in any desired succession.

In a furnace of this description I burned colored fires for an hour without the slightest disagreeable odor being perceptible in the room. Hoping my experience might prove of value to some of your many readers, I remain,

Yours truly,

W. K. Roy.

Wappinger's Falls, N. Y., December 11, 1880.

Indian Ethnology.

Major J. W. Powell, Chief of the Bureau of Ethnology, Washington, lately gave to the *Republic n,* of Omaha, Neb., information to the effect that there are now eight official parties in the field engaged in making a study of the North American Indians—their condition, their habit of life, their languages, their history, etc., as well as taking a census of them. These parties, who are roughing it with tents, mule teams, etc., are scattered throughout California, Nevada, Utah, New Mexico, and Arizona, and Major Powell was then on his way to visit them all to ascertain personally how they are progressing with their work. The taking of the Indian census was begun October 1, and will probably not be finished until next spring, owing to the scattered locations of the various tribes. The name of every Indian is written out in full, together with age, sex, etc., and other statistics are obtained, just the same as of the civilized citizens of the United States, so far as practicable. Besides these eight ethnological parties who are doing this work, there are special agents of the Census Bureau who are assisting with the various Indian agents. It is estimated that the total number of Indians in the United States will foot up over 300,000. One of Major Powell's parties has just discovered in New Mexico and Arizona a number of old ruins and pueblos, which means old Indian villages. These are now being carefully explored. In New Mexico they have discovered, west of Santa Fé, the largest collection of ruins ever found on this continent.

Sea Elephants at Heard Island.

Heard Island is a barren formation 25 miles long, 6 miles broad, area 80 square miles, a considerable portion covered with glaciers. It is situated in about lat. 53° 10′ S. and long. 73° 30′ E., being about 2,500 miles southeast of the Cape of Good Hope, and 300 miles south of Kerguelen's Land. Heard Island is of volcanic origin. In the central part of the island a mountain, known as Big Ben, rises to a height of 7,000 feet. The island was visited by the steamer Challenger in 1874, and Mr. H. N. Moseley, in his "Notes by a Naturalist on the Challenger," gives the following particulars relating to sea elephants, which are found there in great abundance:

The sealers said that the climate of Heard Island was far more rigorous than that of Kerguelen's Land.

In winter the whole of the ground is frozen and the streams are stopped, so that snow has to be melted in order to obtain water.

In December, at midsummer, there is plenty of sunshiny weather, and Big Ben is often to be seen.

It is possible to land in whaleboats, on the average of the whole year, only once in three days, so surf-beaten is the shore, so stormy the weather.

We saw six sealers. Two were Americans, and two were Portuguese, from the Cape Verde Islands.

They were left on the island by the whaling vessels which we met with at Kerguelen's Land, their duty being to hunt sea elephants.

The men engage to remain three years on the island, and see the whale ships only for a short time in the spring of each year. On the more exposed side of the island there is an extensive beach, called Long Beach.

This is covered over with thousands of sea elephants in the breeding season, but it is only accessible by land, and then only by crossing two glaciers, or "icebergs," as the sealers call them.

No boat can live to land on this shore, consequently men are stationed on the beach, and live there in huts, and their duty is constantly to drive the elephants from this beach into the sea, which they do with whips made of the hide of the elephants themselves.

The beasts thus ousted swim off, and often "haul up," as the term is, upon the accessible beaches elsewhere, and there they are killed, and their blubber is taken to be boiled down.

In very stormy weather, when they are driven into the sea, they are forced to betake themselves to the sheltered side of the island, hence the men find that stormy weather pays them best.

Two or three old males, termed "beach masters," hold a beach to themselves, and cover it with cows, but allow no other males to haul up.

The males fight furiously; and one man told me that he had seen an old male take up a younger one in his teeth and throw him over, lifting him in the air.

The males show fight when whipped, and are with great difficulty driven into the sea. They are sometimes treated with horrible brutality.

The females give birth to their young soon after their arrival. The new-born young are almost black, unlike the adults, which are of a light slate brown, and the young of the Northern bladdernose, which are white.

They are suckled by the female for some time, and then left to themselves lying on the beach, where they seem to grow fat without further feeding. They are always allowed by the sealers thus to lie, in order to make more oil.

This account was corroborated by all the sealers I met with. I do not understand it. Probably the cows visit their young from time to time unobserved. I believe similar stories are told of the fattening on nothing of the young of Northern seals.

Peron says that both parent elephant seals stay with the young without feeding at all, until the young are six or seven weeks old, and that then the old ones conduct the young to the water and keep them carefully in their company. The rapid increase in weight is in accordance with Peron's account.

Charles Goodrich gives a somewhat different account, namely, that after the females leave the young, the old males and young proceed inland, as far as two miles sometimes, and stop without food for more than a month, and during this time lose fat.

The male elephants come on shore on the Croyets for the breeding season at about the middle of August, the females a little later.

There was said to be forty men in all upon Heard Island. Men occasionally get lost upon the glaciers.

Sometimes a man gets desperate from being in so miserable a place; and one of the crew of a whaler that we met at Kerguelen's Land said, after he had had some rum, that occasionally men had to be shot; a statement which may be true or false, but which expresses, at all events, the feelings of the men on the matter.

The men that we saw seemed contented with their lot. The "boss" said, in answer to our inquiries, that he had only one fur seal skin, which he would sell if he was paid for it; but he guessed he'd sell it anyhow when he got back to the States.

He had been engaged in sealing about the island since 1854, having landed with the first sealing party which visited the island.

For his present engagement his time was up next year, but he guessed he'd stay two years more.

He'd make five hundred dollars or so before he went home, but would probably spend half of that when he touched at the Cape of Good Hope on the way. The men had good clothing, and did not look particularly dirty.

They lived in wooden huts, or rather under roofs built over holes in the ground, thus reverting to the condition of the ancient British.

Around their huts were oil casks and tanks, and a hand barrow for wheeling blubber about. There were also casks marked molasses, flour, and coal.

The men said they had as much biscuit as they wanted, and also beans and pork, and a little molasses and flour. Their principal food was penguins (*Eudyptes chrysolphus*), and they used penguin skins with the fat for fuel.

Captain Sir G. S. Nares saw five such skins piled on the fire one after the other in one of the huts.

MISCELLANEOUS INVENTIONS.

A tool for holding small articles or pieces of jewelry while being soldered, so as to dispense with binding wire, plaster of Paris, and the various inconvenient, troublesome, and dirty contrivances hithertofore used in such work, has been patented by Mr. Louis G. Grady, of Halifax, N. C. This invention consists in a bar or plate provided with articulated arms that carry tweezers, the parts being so constructed and arranged that the articles or parts can be placed in the tweezers and brought together and held in any required position for being soldered.

An improved time signal for railways has been patented by Mr. Horace A. Wayne, of Manlius Station, N. Y. The invention consists in the combination of a clock with hands and dial as usual, and a clock movement without an escapement, that moves the hands of the indicating dial, and having a stop lever that is released by the passing train, the two clocks being so connected that the indicator remains immovable until a train passes, when it is released and moves until its hands catch up with or indicate the clock time, and it is again stopped.

Mr. Oliver Bryan, of New York city, has patented a hot air furnace, so constructed that the air when heated will be pure, the heating surfaces can be readily inspected and cleaned, and the fire will act instantly and uniformly upon all the heating surfaces, making the expansion equal and the radiation of heat quick and regular.

Mr. Abraham Mayer, of New York city, has patented an improved optometer or instrument for ascertaining the number and kind of glasses required by persons having an impaired sight, making the use of spectacles necessary. The invention consists in a case containing one or more sets of lenses arranged on an endless band in such a manner that a standard card, which is held on the end of an adjustable pivoted arm, can be read through the several lenses successively, so that the lenses suiting the eyes of the experimenter can be determined very easily and rapidly.

An improved furnace for burning chaff, etc., has been patented by Mr. Alonzo Moore, of Bangkok, Siam. In ordinary furnaces fuel is usually supplied at intervals, which chokes to a considerable extent the evolution of gases from the combustion. In so supplying the fuel the boilers are exposed to sudden changes of temperature, causing injurious expansions and contractions. To overcome these objections is the object of this invention.

Mr. H. L. Warren, of Alma, Ohio, has patented a fan blower for thrashers, by the use of which the feeders and band cutters will be protected from the cloud of dust that constantly issues from the mouth of the machines.

Mr. James R. Barry, of Yonkers, N. Y., has patented a combination puzzle and game apparatus, which consists of a short rod, a stationary handle, and four or more balls or short cylinders having alternate numbers and letters formed upon them in such an order that when the balls are arranged in a particular position the sum of the various columns of numbers will be the same, and the various columns of letters will spell words.

A harness buckle, the tongue of which may be locked upon the buckle frame, and of such construction that the pull of the engaged trace or strap shall be straight, and not at an angle thereto, has been patented by Messrs. Casper L. Marschall and Anthony Marschall, of Evansville, Ind.

A calendar, to be attached to a clock and operated in connection therewith, and exhibits but one number or date at a time, and that number or date in large or plain figures, has been patented by Mr. Peter Wagner, of New York city.

An improvement in the tunnels of base burning stoves, whereby the coals can be retained in the tunnel in case a weak fire is desired or in case the fire has gone out and the ashes and cinders are to be removed, so that the coal in the tunnel can be dropped on to a fresh fire, has been patented by Mr. Edward C. Smith, of Lincoln, Neb.

Mr. Charles L. Shaw, of Nora, Ill., has patented an improvement in flood gates for streams, hollows, and lowlands liable to be overflowed by a sudden rise of water. They are so constructed that they will not wash away, and will allow the water, and any rubbish being carried down by the water, to pass freely.

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Mr. Marshall Pratt, 55 Beekman street, New York city, is introducing a novel, efficient, and cheap razor strop, consisting of a finely grooved wooden strop saturated with a fixed oil and coated on both sides with an improved paste.

Mr. Timothy B. Rider, of Fitch Bay, Quebec, Canada, has patented an improvement in the class of automatic safety attachments for steam boilers whose function is to dampen or extinguish the fire by allowing escape of water from the boiler into the fire box in case the water becomes too low or the steam pressure too high for safety. The inventor employs a tank containing a float and lever which operate a valve that controls escape of water to the fire box, as heretofore, but he has so constructed and arranged these parts as to make the apparatus more compact, less liable to get out of order or become inoperative, and more efficient generally.

An improved disk mill for crushing and grinding different materials has been patented by Mr. Carl Fink, of Berlin, Germany. This apparatus, it is said, operates much more rapidly and easily than vertical millstones or ordinary crushing mills, and the disks can be cooled in a more efficient manner than the stones or rollers of ordinary mills.

Mr. W. Clay Lutz, of Bedford, Pa., has patented an improvement in that class of railroad cross ties in which the material used is metal.

Messrs. Hermann Koeller, of New York city, and Charles Nimmo, of Greenpoint, N. Y., have patented an improved drip oil cup. The object of this invention is to provide an improved oil drip cup for the crank connections of steam engines and other mechanism, which can be adjusted to fit any connection, and not only catches the oil that drops from the journal, but also the oil or grease that is thrown from the crank connection by centrifugal force.

An improvement in the class of dogging apparatus which is affixed to one of the knees of a head block of the log carriage, has been patented by Mr. William J. Wickham, of Forest Home, Texas.

Mr. Frederick Koskul, of Grand Rapids, Mich., has patented a process of treating metallic foil to form veneers, which consists in, first, painting or lacquering it; secondly, varnishing it; thirdly, baking it; and fourthly, subjecting it to pressure.

An improvement in steam boilers and furnaces has been patented by Mr. Joseph E. Culver, of Jersey City, N. J. The improvement relates to steam generators wherein the heated products of combustion may be commingled with the steam for use with an engine, or for heating purposes, or used separately.

Mr. Jacob R. Scott, of Nyack, N. Y., has patented improvements which relate to machines for sewing boots and shoes of the class wherein a rocking looper is fitted in the horn. The object of the invention is to provide means whereby the looper will always be held in the proper position relative to the needle while the horn turns.

New Plan for the Drainage of Chicago.

A committee appointed by the Citizens' Association, of Chicago, to devise a system of improved drainage adapted to the present and future needs of the city have reported in favor of a vast sewer to drain the entire district traversed by the Chicago River. The estimated cost of the work is $6,850,000, but it is thought that to complete it in every respect the sum of $12,000,000 will probably be necessary. The line of the proposed sewer, as shown in the map made by the engineer of the committee, Mr. A. J. Mathewson, is as follows: Commencing at the mouth of the Regula or Mud Lake fork of the south branch of the Chicago River it runs west through the lake toward the Desplaines River north of Summit; then curving to the left it passes in a southwest direction between the canal and the river to Mount Forest, Willow Springs, Sag Bridge Station, and Lemont to the Romeo bend of the canal, Norton's tail race at Lockport, and to a point opposite lock No. 1 at Lockport; thence to a point at the head of the pond of dam No. 1, Joliet, a few hundred feet northwest of Lock No. 4, of the Illinois and Michigan Canal, a distance not far from 31½ miles.

For the southwestern terminus the sewer runs about 2½ miles N.N.E. to a point opposite Lock No. 1, with a fall to the south of about 12 feet in bottom of sewer, or $4\frac{8.9}{100}$ feet fall per mile, and the average width of 15 feet; thence north and northeast, past Romeo and Lemont, Sag Bridge Station, Willow Springs, Mount Forest, Summit, and Mud Lake, or regular route, touch Bridgeport, a distance from Lock No. 1 of 20 miles, and an ascent of 1 foot per mile, making 29 feet fall from Bridgeport to Lockport in bottom of sewer, with a width of sewer at lower end of 20 feet, and at upper end of 49 feet for compensation.

Good, substantial abutments and bridges at all crossings will be necessary throughout, and at Big Run, Norton's tail race, and Fraction Run an arch about 300 feet long, in each, will be needed to let the water from these several places pass over the top of the sewer. The eastern portion of this route is already excavated to about the proper width, but not to the proper depth. The sewer when completed should draw water from the surface to the bottom of the river, low water, datum line for the first 29 miles. A portion of West Chicago and the town of Cicero, under an arrangement with the city, may drain directly into the main sewer. The amount of excavation for the above sewer, by a careful approximate estimate will be 3,031,285 cubic yards; cost of excavation—earth and rock, slope wall, inverted arch in bottom, and the three arches aforesaid, $6,365,698; contingencies, engineering, etc, $483,625; total cost, $6,849,323.

New Memphis.

The Memphis *Avalanche* declares that all sanitarians who have examined the successful working of the new sewer system of that city, and who are familiar with the sanitary condition of other American cities, agree that Memphis is the best sewered and best drained city on the continent. The absence of sewer gas, the abolition of all privy vaults, and the thorough underdrainage of the soil, are marked features of the Memphis sewer system that are lacking in other cities The effect of this thorough sanitary revolution, the *Avalanche* continues, cannot but have a marked influence in decreasing the mortality rate, and it may confidently be anticipated that Memphis will hereafter be entitled to be styled not only the cleanest but the most healthy city on the continent.

How many other American towns and cities are waiting, as Memphis did, to be depopulated and threatened with general bankruptcy in business as well as in health, by repeated epidemics, before adopting an adequate system of general sanitation?

The Atlanta Cotton Fair.

A grand international exhibition of the appliances and machinery used in raising, preparing, and manufacturing cotton, with samples of cotton fiber and fabrics, and all other matters bearing upon the cotton interests, is announced to be held in Atlanta, Georgia, during October and November next. At a large and enthusiastic meeting of business men in Atlanta, December 2, the International Cotton Exhibition Association was organized with the following named officers: President, Senator Joseph E. Brown, of Georgia, and twenty-five vice-presidents from the principal cities and manufacturing towns of the country; Treasurer, Samuel M. Inman, of Atlanta; Secretary, John W. Ryckman, of Philadelphia; Executive Committee, the Mayor of Atlanta, *ex-officio*, Chairman, H. J. Kimball, R. F. Maddox, W. I. Calhoun, B. E. Crane, W. H. Patterson, M. C. Kiser, Evan H. Howell, and W. B. Cox, of Atlanta; Edward Atkinson, of Boston; Richard Garsed, of Philadelphia; Cyrus Buzby, of New Orleans; J. W. Paramore, of St. Louis; John H. Inman, of New York. The Finance Committee are: Robert J. Lowry, Paul Romare, and D. N. Spear, of Atlanta; Morris Ranger, of New Orleans; Thomas Dolan, of Philadelphia; William A. Burke, of Lowell, Mass.; William Gray, Jr., of Boston, Mass.; and J. H. McMillen, of Biddeford, Me.

The Adirondack Survey, New York.

The year's field work of the Adirondack Survey, under Mr. Verplanck Colvin, was ended December 1, when the superintendent and his assistants returned to Albany. The last triangulation station was on Bluebeard Mountain, near Lake Pharaoh. The mountains had been covered with snow for two months; very heavy snowfalls occurred about the middle of October.

The measurements of the season extend the work to the southeastern borders of the Adirondacks, and cover the location of a great number of trigonometrical stations in the counties of Essex, Hamilton, Warren, and Saratoga, and the northeast corner of Washington County. The heights of a great number of mountains, until now unmeasured, with altitudes of lakes and other new prominent points in those counties, have been determined, measurements of vast numbers of air-line distances for the purpose of locating signals, mountain lakes, and land lines have been made, together with special surveys of lakes and rivers. A full account of these new measurements will be given in Superintendent Colvin's next report to the Legislature.

Wickersheimer's Preserving Fluid.

According to the Boston *Journal of Chemistry*, the following is said to be the formulæ now adopted by prominent manufacturers in Berlin for this liquid, according as it is to be used for injecting or immersing bodies:

	For injecting.	For immersing.
Arsenious acid	16 grammes.	12 grammes.
Sodium chloride	80 "	60 "
Potassium sulphate	200 "	150 "
Potassium nitrate	25 "	18 "
Potassium carbonate	10 "	15 "
Water	20 liters.	10 liters.
Glycerine	4 "	4 "
Wood naphtha	¾ liter	¾ liter.

Hager suggests the following as a substitute for Wickersheimer's preparation:

Salicylic acid	4 drachms.
Boracic acid	5 "
Potassium carbonate	1 drachm.
Dissolved in hot water	12½ ounces.
Glycerine	5 "

Then add—

Oil cinnamon, oil cloves, each 3 drachms, dissolved in alcohol	12½ ounces.

The latter fluid is not poisonous, and possesses the desirable property of acting as an antiseptic, and also as a preventive and exterminator of moths and vermin, and is possessed of a pleasant odor. The borosalicylate may be used in connection with other solvents if desired.

Progress in Silk Manufacture in America.

During a recent visit to the silk mills of Paterson, N. J., Mr. Brocklehurst, of Macclesfield, England, a member of one of the largest silk manufacturing firms in the world, was much impressed by the rapid progress which the silk industry is making in this country. He was especially surprised by the general use of steam power looms in weaving the more delicate and costly fabrics, an improvement only now being tried experimentally in England, and by the wide scope and variety of the work done in each and all the mills.

A Big Melon Patch.

Missouri boasts of possessing one of the largest and most productive melon patches in the United States. It is situated on the borders of Scott and Mississippi counties, and equals if it does not exceed in size and adaptation of soil and climate the famous melon patches of Georgia, Indiana, and the eastern shore of Maryland. The St. Louis *Republican* describes it as a tract of sandy prairie, four miles wide and ten miles long, with a thin, warm soil, just adapted to the cultivation of the melon, and such melons as are raised nowhere else in that region. There is much richer and deeper soil all around there, but it is not adapted to melon culture. This land is capable of producing 1,000 melons to the acre. At a place called Diehlstadt, in Scott County, there were shipped the past season 439 car loads of 1,000 to the car, and Bertrand, in Mississippi County, shipped 180 car loads, mostly to Chicago. The melon county was visited by 25 commission merchants from Chicago, who paid as low as $40 and as high as $140 per car load, being an average of $70 per car, the market price varying with the advance of the season and the number of melons ripening at the same time. Most of these melons were shipped over the Cairo and Vincennes and Illinois Central Railroads in fruit cars, properly ventilated and arranged for the purpose. These melons found their way not only to St. Louis and Chicago, but to most of the lake cities, and even to New York and Philadelphia.

Melons are getting to be such a staple of production that the cultivators are asking for increased railroad facilities to move the product at the proper season, and recently the Hon. Henry J. Deal, the newly-elected member of the Legislature from Charleston, Mississippi County, applied to Superintendent Soper, of the Iron Mountain Railroad, with a petition numerously signed, representing that they will plant 700 acres more next year in melons if the railroad will give them a side track and station at a point on the Iron Mountain Railroad three miles north of Charleston, to be called Melon Station. Mr. Soper gave assurance that he would comply with the request of the petition. Col. Deal estimates that 700 acres ought to produce 700 car loads, at the rate of 1,000 melons to the acre, making 700,000 melons. One man can attend to twenty-five acres of melons. The variety of seed used is that of the Georgia melon, which is very luscious and grows to a great size, some weighing as high as 60 pounds. The hills are planted 14 feet each way apart and from three to four seed are put in a hill. They commence shipping melons about the 20th of July, and continue to the last of August.

Spontaneous Combustion of Soft Coal.

The Boston Manufacturers' Fire Insurance Company states that at present rates of prices semi-bituminous and soft coals are coming into more general use than they have been, especially culm or fine coal.

Members are warned that, with few exceptions, such coals are very liable to spontaneous combustion, if stored when the least wet or damp in closed sheds where there is little or no circulation of air. If such coal is not protected from being wet, it is said to deteriorate.

The company objects to the storage of semi-bituminous or bituminous coal in or under any building covered by its policies, or in or under any building that would expose a risk taken by this company to danger if it took fire.

It is suggested that a roof may be sufficient to protect soft coal from being much wet, and that, under a roof not confined at the sides, there would probably be such a free circulation of air as to prevent spontaneous combustion.

Photography in Engineering Works.

Photography has been employed by our large engineering and manufacturing firms for a long time. An English photographic journal speaks of some of their engineering establishments having photographic studios attached to their works, as if it was a new thing. Referring to those having such a department, the editor says Sir William Armstrong, at Elswick, and Sir Joseph Whitworth, at Manchester, may be cited among others; while the eminent firm of gun-makers, Krupp & Co., in Westphalia, employ not only a photographic staff, but practice collotype printing and other elaborations of the photographic art.

Mercantile Shrewdness.

The London *Hatters' Gazette*, referring to the fact that China grass hats, which an American manufacturer had tried to introduce last season, but which proved an utter failure, adds that they have turned their large stock to a fresh use, and are advertising them as wall pockets. The brims are lined with satin of a bright color and gayly trimmed, and the crown is made to hold a whisk broom and other odds and ends. Trust a Yankee, naively adds the *Gazette*, for sitting down with a dead stock of a novelty which has failed to take!

Shipment of Bees to New Zealand.

Recently four colonies of bees were shipped from California for New Zealand. Each of the boxes in which they were to make their long journey was provided with an attachment at one side carrying a sponge, by means of which the bees were to be supplied with fresh water daily and the atmosphere of the hive kept sufficiently humid. Ventilation was provided for by openings covered with wire cloth and fitted with sliding doors; and a wire-covered cage was attached to each hive for a cooling place for the bees in case the interior of the hive becomes too warm,

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A Locomotive to Run Eighty Miles an Hour.

The Baldwin Locomotive Works have just entered into a contract with Col. G. A. L. Roberts, of Titusville, for the construction of a passenger engine which will be able to run eighty miles an hour, and maintain this rate of speed for 100 miles without stopping. The locomotive is to weigh 38 tons, and will comply with standard gauge. The driving wheels will be six feet in diameter. The forward trucks and those on the tender will be made of paper, which, it is said, will endure more strain and wear than iron or steel. The wheels will all be of the pattern known as the broad-tread, which will enable the engine to run on roads of either 4 feet 8½ inches or 4 feet 10 inches gauge. The most important feature of the locomotive will be the introduction of the Roberts patent cylinder and piston, which has proved capable of saving at least 20 per cent in steam pressure. The exhaust ports are in a continuous circle around the cylinder, in addition to the usual ports at the ends, and the steam escapes without the waste of force necessary to expel it, as in the cylinders of the old style. The tender will be so constructed as to carry a foot of water under the coal, as well as the usual amount on the sides. There will be a water chamber on the locomotive so arranged that compressed air from the air pump can be admitted in the top of the chamber upon the water, by which means a stream may be forced upon any hot bearing connected with the engine or tender. This is expected to overcome the trouble of hot boxes. The nozzles through which the steam is to pass and create a draught will be eight inches in diameter—about three times the usual size—and the boiler will be the largest that can be put upon the standard gauge tracks. It will be the strongest locomotive ever built, and perfect in every detail. Col. Roberts, the inventor, built a similar locomotive a few years ago, which drew the fast mail train over a portion of the Lake Shore Railway, but it was not a success, owing to its poor construction. The improvements it suggested will be taken advantage of in building the new engine. It is stated that Col. Roberts, who has visited Europe several times, and studied the railway systems of that country, is building his new engine for use upon the European Continent.

Tennessee Marble.

Mr. John J. Craig, of Knoxville, Tennessee, says that the United States Government has recently opened and is now working successfully a quarry of white stone in the immediate vicinity of that city which is pronounced by competent judges to be superior to anything of the kind found elsewhere in the United States for building and all out-door purposes. It is a highly crystallized limestone marble—and as it comes from the hammer or chisel is almost perfectly white; when polished it shows a faint pinkish blush, most delicate and beautiful; long exposure to the atmosphere seems to whiten and harden it, a sort of glass-like enamel forming over its surface and rendering it almost entirely impervious to dampness and stains of any kind. A column of this marble, which has been standing in Knoxville more than thirty years, and which has never been touched with brush or soap, is as white and clean to-day as it was the day it was first exposed to the storms and sunshine of our fickle climate. The texture and working quality of the marble is unsurpassed. It is neither too hard nor too soft, but exactly soft enough to allow the sculptor to work it without force and trace on it the finest lines of finished form, and yet hard enough to retain these lines in all their original delicacy, unimpaired by wind and rain, for generations to come. The quantity of the marble is unlimited. Knoxville is surrounded by whole mountains of it. Facilities for transportation are now good and daily growing better. Car loads are being daily shipped to all sections of the country, and the absence of capital alone prevents the quarrying of it from soon developing into one of the most important industries in that singularly favored but as yet almost unknown section.

The Paterson, N. J., Artesian Well Strikes Salt Water.

In the SCIENTIFIC AMERICAN of January 31, 1880, an account was given of the progress of the artesian well of the Passaic Rolling Mill until quicksand was struck at the remarkable depth of 1,100 feet. The well was piped through the quicksand and the boring continued. At a depth of 2,000 feet water was struck, the well having previously been so dry below the quicksand that water had to be poured in to lubricate the drill. The boring was continued to a depth of 2,053 feet, the water increasing in volume until it rose to within 32 feet of the surface. But this water was salt: Samples were sent to Prof. Cook, the State Geologist, who caused an analysis to be made. This showed that the water contained 974 grains of various salts to the gallon, about half of which was common salt. There was also a considerable percentage of chloride of calcium and magnesium, about 7 per cent of chloride of potassium, and considerable sulphate of lime, with mere traces of iodine and bromine.

Prof. Cook says he does not know what this water can indicate, unless it be that the well has got down pretty near to rock salt. From recent indications it appears probable that if the well were continued still further the water would flow out of the top, but as the company has no use for salt water in rolling and working iron it has been decided to abandon the project of securing a flowing well. The hole will be plugged below the quicksand, or about 1,120 feet below the surface, and the water will be pumped, an abundant supply of fresh, cool, and pure water being assured at that point.

The Yuba River Brush Dam.

The Marysville (Cal.) *Appeal* describes as follows the construction of the dam across the Yuba River, nine miles above Marysville, to restrain the mining *débris* and to improve the river channel. An excavation was made about one foot in depth and sixty feet wide, the ground at that depth being frequently very solid. This excavation was made across the whole distance. In this were trenches in which were placed logs spliced together at the ends and securely staked down. A mattress was then made upon an inclined scaffolding. Willow brush was laid on the scaffold, butt ends and tops alternating so as to be close together and bind well, there being enough large brush to hold the mass and enough small and short to fill all the space. None but assorted straight willow brush was used anywhere, those pieces with wide or spreading branches being cast away. This mattress, about sixty feet in width and two feet in thickness, was then sewed together with strong wire until it was pressed to one foot in thickness. The frame or scaffold was drawn from under by horses, and the dense mass sunk upon the stringers and was sewed down to them and otherwise securely fastened. Though the mattress was necessarily made in pieces, these were all sewed together at the ends, making it continuous. This was all covered with two feet of earth, and continued driving over it has packed the ground. This is intended to prevent the wash from the water that flows over or through the dam.

On top of the mattress and earth, but a few feet below the upper edge of it, begins a layer of logs laid together closely, sewed with wire and sewed to the mattress beneath. On this are stringers and then two more layers of logs, all with butts down stream and top ends running into the ground up stream. They were all secured in the same manner to the mass below and loaded with dirt. The line of the butt ends of each successive layer is further up stream, of course, forming a sort of stairway from the bottom. Earth and sand are used to fill all the crevices. The length of the dam is between 10,000 and 11,000 feet, or nearly two miles, and it averages eight feet in height. There is no part of it that is not firmly wired to every other part. Statistics are not generally very effective in description, but some idea of the way in which it is all matted together may be given by the statement that considerably more than 100 miles of wire has been used, and, independent of brush, there are in the structure just 117,400 logs, averaging six inches in diameter at the butt and thirty feet in length.

Though the distance between the highlands on either side of the basin is about two miles, the present channel of the river is comparatively narrow. To connect the two sections of the dam the channel had to be vacated by turning the course of the river by the construction of a wing dam of brush across the channel a quarter of a mile above the gap. The capacity of the first attachment basin is equal to 75,000,000 cubic yards of *débris*. When filled to the level of the dam, another dam will be built on the top of the first and so on.

A Gigantic Iron Pier Pound-net Proposed.

The Long Island Fish Company, of this city, proposes to engage in pound fishing on a scale hitherto undreamed of. Already a large tract of land has been purchased at the eastern end of Long Island, extending about a mile along the coast. At this point, which is eminently favorable for pound fishing, since the fish that run along the coast here come very close to the shore, the company propose to construct a gigantic weir supported by iron piles, forming an iron pier 700 feet long and ten feet wide, with bents or sections twenty feet long. At the outer end of the pier, in thirty feet of water, will be a heart-shaped pound, the large end of the heart inshore. This heart will be about seventy feet across, and outside of it is to be a box of iron piles and netting about seventy-five feet square. The fish coming from either direction and striking the pier netting will run out seaward to the heart, and, passing out at the lower end, will find themselves in the outer receptacle. In the sections of the iron weir storage for thousands of tons of fish can be provided, where they will keep alive in their native element for a month or longer, and need not be immediately brought to market when the price is low.

The great advantage of an iron weir lies in its stability and freedom from attacks by worms. The netting fence runs down to the bottom of the water so as to stop ground-swimming fish. The pound has a net bottom, and when filled with fish is lifted and the fish dipped out with hand nets.

Piers at French Ports.

The construction of a new pier has just been commenced at Nice, and it is expected that it will be finished and opened to the public in about two years from the present time. The total area of the pier and pier-head will be 65,000 square feet, and the piles at the pier-head will be in water varying from 26 feet to 33 feet deep. On account of the absence of the tide in the Mediterranean and the rapidly increasing depth of the water, the length will be 300 feet, but the building on the pier-head, according to a correspondent, will be larger, more substantial, and of a more ornamental character than is usually the case with English piers. It will contain a large central hall, or concert room, a restaurant, billiard room, and all other necessary adjuncts of a casino, and the arrangement of the bracing under the pier-head is especially designed to give ample space for two large swimming baths. Under the same auspices the construction of piers will soon be commenced at Cannes, Dieppe, and Trouville.

NEW INVENTIONS.

Mr. John C. Wharton, of Nashville, Tenn., has patented an improved shelving which is dust proof and exhibits the articles placed thereon to the greatest advantage, and is also ornamental. The invention consists in a series of shelves provided with glass fronts, forming closed boxes or compartments, which are arranged in such a manner that each shelf projects beyond the next lower one, thus permitting receptacles containing the article to be exhibited to be placed upon the shelves through apertures in the bottom thereof. The receptacles are provided with some suitable locking device for holding them on said shelves.

An improvement in electric lamps has been patented by Mr. John H. Guest, of Brooklyn, N. Y. The object of this invention is to furnish means for automatically regulating the length of the arc in electric lamps, and to prevent fluctuations in the light by changes in intensity of current. It consists, primarily, in a thermoscopic rod combined with an electric lamp for expansion according to the intensity of the current and resistance in the circuit. The lineal expansion is multiplied by levers, which act by clamps to separate the carbons.

Messrs. Robert Quintavalle and Theodore Lindberg, of Brooklyn, N. Y., have patented an improvement in the class of fire escapes adapted to be suspended from a window of a building. It is more particularly an improvement upon such apparatus as consists of a frame that is designed to be attached to a window-sill, and is provided with a curved standard, from which a basket or other receptacle for persons and goods is suspended by means of a rope running through a sheave or pulley block.

Mr. George Oliver, of the City Road, County of Middlesex, England, has patented an improved apparatus for enabling a performer to ascend to or descend from a considerable height from a stage or platform, either in a vertical or oblique direction, as may be required, or for personating a bird, for instance, or other character suspended in mid-air.

An improved clasp for pocketbooks, satchels, etc., which is simple and convenient, has been patented by Mr. John G. Klett, of Brooklyn, N. Y. The invention consists in a spring plate provided with a knob or button, and with flanges on the opposite ends, one of the flanges being securely attached to one part of the frame of a pocketbook, satchel, etc., while the other catches on a stud on the other part of the frame, or catches on the edge of the frame itself.

An improvement in stereotype casting boxes has been patented by Mr. William E. Gump, of Brooklyn, N. Y. The object of this invention is to secure adjustable gauges to a casting box, and do away with the separate frames between the lids of the box, so as to save time, labor, and cost.

An improved oil stove wick-trimmer has been patented by Messrs. Martin W. Walker and George E. Williams, of Sing Sing, N. Y. In ordinary oil-burning stoves it is necessary to remove the top of the stove and the utensils on it to trim off the crust that forms on the wicks and interferes with the proper action thereof. The object of this invention is to avoid the inconvenience attendant upon this process of removing the crusts on the wicks.

Mr. Conrad Blattner, of St. Louis, Mo., has patented an improved permanent roll for a detachment of troops, the members of a police force, or other organized body, designed to indicate at a glance the absence, presence, physical condition, character of duty engaged in, etc., of each and every member of the body.

An improvement in dental forceps has been patented by Mr. William P. Tisdale, of Pass Christian, Miss. The invention consists in a rod bifurcated at one end and a rod that has a head embracing the elastic prongs or bifurcations, so as to open and close the jaws which form a part of the prongs, the slide rod being operated by a hand screw.

Mr. William J. Ormsby, of Cincinnati, O., has patented an improvement in that class of air-carbureters in which the tank or reservoir containing the gasoline or other carbureting liquid is placed above but in communication with the pans or trays intended to receive from time to time a limited portion of the liquid, and through which the air to be carbureted is successively passed.

An improved device for removing vitiated air from dwellings and other buildings by the vacuum process, has been patented by Mr. James F. Baldwin, of Lockport, N. Y. It is adapted for connection with a stove, stovepipe, or flue, and may be placed on the floor or otherwise suitably arranged within the room to be ventilated, and the air is drawn into it and it passes into the pipe, a current being induced by the draught in the chimney.

An improved machine for crushing, grinding, and pulverizing the valuable ores in order that by comminution the metallic portion may be separated from the gangue, has been patented by Mr. Royal C. Grant, of Middleport, O. This machine is of that class in which a tapering or cone-like shell revolves around a core of corresponding shape.

A cheap, simple, and efficient apparatus for generating or producing illuminating gas, has been patented by Mr. Geo. H. Burrows, of Somerville, Mass.

Mr. John Q. Crosby (Hezekiah H. Crosby, administrator), of Yonkers, N. Y., has patented an improvement in the class of reels having an iron frame provided with pivoted braces or legs adapted to be folded for the purpose of transportation, etc. The invention relates to the construction of and means for locking the reel proper or the revolving part on which the hose is wound; also, to the construction of the holder for the nozzle of the hose.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

A Practical Gass Maker, having ten years' experience, desires a situation. Address Glass Maker, Box 773, N.Y.

Safety Linen Hose; a protection from fire for factories and stores. Greene, Tweed & Co., 118 Chambers St., N.Y.

Eureka Vegetable Boiler Scale Eradicator, strictly vegetable, and perfectly harmless to iron. Warranted to remove scale of any thickness, and to prevent scaling from either fresh or salt water use. Circulars and particulars of G. E. Brinckerhoff, 107 Liberty St., N. Y.

Machinists' Tools and Special Mach'y. See adv., p. 12.

Toope's Patent Felt and Asbestos Non-conducting Removable Covering for Hot or Cold Surfaces; also Toope's Patent Grate Bar. Charles Toope, M'f'g Agent, 353 E. 78th St., New York.

The Sweetland Clutch. See illus. adv., p. 12.

Hotchkiss' Mechanical Boiler Cleaner, 84 John St., N. Y., operates by circulation, trapping mud constantly, keeping water purified. No cost save first. Engineers make ten per cent selling other parties than employers.

Moulding Machines for Foundry Use. 33 per cent saved in labor. See adv. of Reynolds & Co., page 12.

Engines repaired without loss of time. L. B. Flanders Machine Works, Philadelphia, Pa.

Soapstone and Empire Gum Core Packing. Special rates to large buyers. Greene, Tweed & Co., New York.

The I. B. Davis Patent Feed Pump. See adv., p. 12.

No one using steam can afford the loss of fuel and power consequent upon the use of inferior non-conducting steam pipe and boiler coverings. Asbestos has proven the most effective and economical material for the purpose, and is employed in the form of a cement and a fireproof felt for a lining or insulator under hair, felt, etc. The genuine Asbestos Coverings are manufactured only by the H. W. Johns M'f'g Co., 87 Maiden Lane, New York.

For Sale.—Yacht, 5′ x 35′, without machinery. Address Box 160, Owego, Tioga Co., N. Y.

The Best Device to Communicate Power to Sewing Machines in Factories, is made by J. A. Sawyer & Son, Worcester, Mass.

Wanted—Second-hand Woodworking Machines; and to sell, two Iron Lathes. R. K. Teller, Unadilla, N. Y.

Jenkins' Patent Valves and Packing "The Standard." Jenkins Bros., Proprietors, 11 Dey St., New York.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

A perfect Mowing Machine is an absolute necessity to a farmer. The best made is the Eureka. It has the lightest draught, and will cut at least one-third more grass per hour than any other mower. Simple in construction and durable. Prices reasonable. Send for illustrated catalogue to Eureka Mower Co., Towanda, Pa.

Wren's Patent Grate Bar. See adv. page 397.

Exporters of Machinery for Plantations. Sugar Machinery, Coffee Huller and Cleaners. Information and estimates on all classes of American machinery and patented devices. Agricultural Implements and Hardware. Jos. H. Adams & Son., 283 Pearl St., New York.

The Mackinnon Pen or Fluid Pencil. The commercial pen of the age. The only successful reservoir pen in the market. The only pen in the world with a diamond circle around the point. The only reservoir pen supplied with a gravitating valve; others substitute a spring, which soon gets out of order. The only pen accompanied by a written guarantee from the manufacturers. The only pen that will stand the test of time. A history of the Mackinnon Pen; its uses, prices, etc., free. Mackinnon Pen Co 200 Broadway, New York.

Superior Malleable Castings at moderate rates of Richard P. Pim, Wilmington, Del.

Wood Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

The "1880" Lace Cutter by mail for 50 cts.; discount to the trade. Sterling Elliott, 262 Dover St., Boston, Mass.

The Tools, Fixtures, and Patterns of the Taunton Foundry and Machine Company for sale, by the George Place Machinery Agency, 121 Chambers St., New York.

Experts in Patent Causes and Mechanical Counsel. Park Benjamin & Bro., 50 Astor House, New York.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsb'g, Pa.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited, Erie, Pa.

Power, Foot, and Hand Presses for Metal Workers. Lowest prices. Peerless Punch & Shear Co., 52 Dey St., N.Y.

4 to 40 H P. Steam Engines. See adv. p. 381.

Recipes and Information on all Industrial Processes. Park Benjamin's Expert Office, 50 Astor House, N. Y.

For the best Stave, Barrel, Keg, and Hogshead Machinery, address H. A. Crossley, Cleveland, Ohio.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 40 John St., N. Y.

Saw Mill Machinery. Stearns Mfg. Co. See p. 397.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

Gun Powder Pile Drivers. Thos. Shaw, 915 Ridge Avenue, Philadelphia, Pa.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Downer's Cleaning and Polishing Oil for bright metals, is the oldest and best in the market. Highly recommended by the New York, Boston, and other Fire Departments throughout the country. For quickness of cleaning and luster produced it has no equal. Sample five gallon can be sent C. O. D. for $8. A. H. Downer, 17 Peck Slip, New York.

Peck's Patent Drop Press. See adv., page 413.

Wright's Patent Steam Engine, with automatic cut off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

Blake "Lion and Eagle" Imp'd Crusher. See p. 397.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 412.

For Separators, Farm & Vertical Engines, see adv. p. 413.

National Institute of Steam and Mechanical Engineering, Bridgeport, Conn. Blast Furnace Construction and Management. The metallurgy of iron and steel. Practical Instruction in Steam Engineering, and a good situation when competent. Send for pamphlet.

Usa Vacuum Oil Co.'s Cylinder Oil, Rochester, N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

For Yale Mills and Engines, see page 381.

Portable Railroads. Sugar Mills. Horizontal & Beam Steam Engines. Atlantic Steam Engine W'ks, B'klyn, N.Y.

Apply to J. H. Blaisdell for all kinds of Wood and Iron Working Machinery. 107 Liberty St., New York. Send for illustrated catalogue.

H. A. Lee's Moulding Machines, Worcester, Mass.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 15,000 Crank Shafts, and 10,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

Brass & Copper in sheets, wire & blanks. See ad. p. 12.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Eagle Anvils, 10 cents per pound. Fully warranted.

Gear Wheels for Models (list free); experimental and model work, dies and punches, metal cutting, manufacturing, etc. D. Gilbert & Son, 212 Chester St., Phila., Pa.

Machine Diamonds, J. Dickinson, 64 Nassau St., N.Y.

The best Truss ever used. Send for descriptive circular to N. Y. Elastic Truss Co., 683 Broadway, New York.

Houston's Sash Dovetailing Machine. See ad., p. 14.

Steam Engines; Eclipse Safety Sectional Boiler. Lambertville Iron Works, Lambertville, N. J. See ad. p. 413.

For Superior Steam Heat. Appar., see adv., page 12.

Magic Lanterns, Stereopticons, and Views of all kinds and prices for public exhibitions. A profitable business for a person with small capital. Also lanterns for home amusement, etc. Send stamp for 116 page catalogue to McAllister, M'f'g Optician, 49 Nassau St., New York.

New Economizer Portable Engine. See illus. adv. p. 12.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

Wm. Sellers & Co., Phila., have introduced a new injector, worked by a single motion of a lever.

Skinner & Wood, Erie, Pa., Portable and Stationary Engines, are full of orders, and withdraw their illustrated advertisement. Send for their new circulars.

Ore Breaker, Crusher, and Pulverizer. Smaller sizes run by horse power. See p. 13. Totten & Co., Pittsburg.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Also manufacturers of Soloman's Parallel Vise, Taylor. Stiles & Co., Riegelsville, N.J.

Green River Drilling Machines. See ad. p. 412.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 413.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 415.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 413.

For Patent Shapers and Planers, see ills. adv. p. 412.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) T. S. & S. ask: How can we make a brass solution that will plate a fox gold color, to be plated on rough cast iron? A. Water (soft), 14 pints; bisulphite of soda, 7 oz.; potassium cyanide, No. 2, 17 oz.; carbonate of soda, 34 oz.; add water, 3½ pints; acetate of copper, 4½ oz.; neutral zinc chloride, 3½ oz. If the deposit is too red use more battery; if too white, less; if earthy or ocherous, add more cyanide; if dull and unequal, add a little arsenious acid in cyanide. They both usually need more or less correction when fresh, it improves on working. Use brass anodes and a pretty strong battery. 2. How to make an electrotyping solution? A. Use a nearly saturated solution of sulphate of copper in soft water. The following gives better results when manipulated by a skilled plater: Bisulphite of soda and pure cyanide of potassium, each 18 oz.; carbonate of soda, 36 oz.; acetate of copper, 17 oz; aqua-ammonia, 12½ oz.; water, 5½ gals.

(2) D. D. writes: I have a lot of waste hard rubber. Can you tell me how to utilize it? Can I make any preparation that will dissolve it so that it will harden afterwards? A. We know of no solvent for the rubber. It is of little use except to the rubber manufacturer, who utilizes it, when ground, to mix with fresh stock.

(3) C. W. D. asks if there is any method of determining how many horse power of steam is passing through a pipe of certain size, the steam pressure being known, the steam used for heating purposes, and thrown into well when condensed; in other words, is there any rule or gauge that will determine what horse power will pass through a pipe of given size, at given pressure, valve full open, and used as above indicated? A. The flow of steam cannot be measured by the horse power, and if so, it would not apply to heating surfaces, as the velocity of flow must depend upon rapidity of condensation; in other words, it will be greatest in coldest weather.

(4) C. & S. ask: What size air pump should we use for a vacuum pan of 200 gallons capacity, temperature used 42° C.? A. Air pump 10 to 12 inches diameter, and 6 or 7 inch stroke, with steam cylinder 7 inches to 8 inches diameter.

(5) F. H. B. asks for a recipe for making a good cologne. A. Oils of lemon, cedrat, and bergamot, each ℥ iij.; oils of lavender, rosemary, and neroli, each ℥ iss.; oil of cinnamon, ℥ vj.; rectified spirit, 3 gals.; spirit of rosemary, 1 quart; compound spirit of balm (eau de melisse des carmes), 3 pints. Digest for eight days, then distill 3 gals.

(6) C. J. H. writes: In making quantitative blow-pipe assays of gold and silver ores, charcoal is recommended for a support in the first fusion of the assay. It is often quite difficult to procure good coals for the purpose, especially when on a prospecting trip. Is there not some kind of material from which small capsules can be made for the purpose, which can be used an indefinite number of times, and which would be equally as good as charcoal? A. We know of no support that will serve as a good substitute for the coal. A small bone ash cupel will answer in some cases.

(7) A. H. L. asks: Will you please specify the kinds of pitch and gutta percha to be used in making cement, also the manner of melting them together? A. Burgundy pitch, melt in an iron pot with as little heat as need be, and stir constantly. The addition of a little shellac will harden it somewhat.

(8) W. W. F. asks: 1. Can you give me a list of the best practical books on the manufacturing of chemicals and dyestuffs? A. Consult Wagner's "Chemical Technology," Watts and Richardson's "Acids, Alkalies, and Salts," and the U. S. Dispensatory and Pharmacopœia. 2. Give the best manner of making an acid solution of bisulphide of soda, with the difference between a bisulphide and a sulphide and a sulphate of soda. A. Acids precipitate the sulphur from the alkaline sulphides. The sulphide may be prepared by boiling together with water for an hour 2 parts of sulphur and 2¾ parts carbonate of soda. Concentrate to small bulk by evaporation, cool, and pour off the liquid from the solid bisulphide. The bisulphide differs from the sulphide only in the large proportion of sulphur it contains. A sulphate is a combination of sulphuric acid with a base, while the sulphide is a compound of sulphur with the same. Consult some elementary book on chemistry, such as Fownes'.

(9) J. W. W. writes. I have a 20 inch by 28 inch engine, taking steam from steam drum 14 inches in diameter, placed across three flue boilers each 44 inches diameter, 20 feet long. Would I get more power out of a 36 inch steam drum; if so, why? A. No: but you would probably get drier steam, which would be an advantage.

(10) G. B. S. asks: In which bearing would a journal run with the least friction, one of one inch in length, or one of three inches in length, other conditions being the same in both cases? A. There would be no difference if the shaft was strictly in line, and the pressure low enough not to approach abrasion of the shorter journal; but the boxes of the longer journal would wear the longest, as the friction would be distributed over a greater surface.

(11) J. F. B. asks: 1. What would be the best mortar to lay fire brick in for lining the fireplace, and flue from a large boiler? A. Fire-clay mortar. 2. What is the highest chimney in the United States and what the height? A. There is one in the vicinity of Pittsburg 275 feet high. We cannot say whether this is the highest. 3. In building a horizontal flue of brick, and lining it with an air space left between, is there any sandstone or other stone that will stand heat well enough to use for lining on bottom and top of flue, and if so, where could it be had? A. Stone is not adapted to this purpose. 4. In building chimneys 300 feet high or higher what mortar is it proper to use outside and inside? A. For outside work hydraulic cement; for inside work, good lime mortar. 5. What coefficient is the most reliable to use for linear expansion of brick work exposed to great heat? A. Clark gives for stock bricks, not laid up, for each degree 0·00141 of an inch in 100 feet length. 6. Knowing the amount of grate surface feeding a chimney, what rule will best determine the necessary inside diameter and height for the chimney to give best results? A. Consult "Wilson on Boiler and Factory Chimneys."

(12) E. B. V. writes: 1. To R. L. J. (2), December 18, 1880, you give ink recipe same as in SUPPLEMENT No. 157. Can you translate the first into a cold process recipe? A. Heat is necessary to properly extract the tannin from the galls. One-seventh the weight of the galls in commercial tannic acid will make a similar ink not requiring heat. 2. After digesting the galls by either the hot or cold process, and a clear solution obtained, which product will retain longest its original excellence in the bottle and black color on the written page, a suspended ink with gum arabic, or a solution with sulphuric acid? A. The fluid or true solution under ordinary circumstances. 3. In recipe above mentioned, would a little blue or purple aniline, soluble in water, replace the extract of logwood equally well as to quality? It would give a pleasing color. A. If you can make it stay in solution, yes. 4 Does the permanganate or any other disinfectant absolutely prevent or only hinder mould; that is, does the dissolved disinfectant remain such, and continue to act while there is fluid about it, or does it evaporate change, or otherwise become neutral with age? A. The permanganate is not used as a disinfectant in this connection; it serves to oxidize the iron salt and render the ink darker when first written with. It suffers decomposition in the reaction.

(13) C. O. M. writes: I wish to take a copper plate, and either print or mark upon it, then apply some acid that will eat away the copper except where I have marked, so that I can print with it. A. Digest coarsely powdered resin with about twice its volume of spirit of turpentine in a bottle immersed in hot water for twelve hours or so; cork very loosely, and shake occasionally; color with lamp black or printer's ink. Apply with a camel's hair brush or pencil, and let stand over night to dry and harden. Use nitric acid diluted with about three parts of water. 2. How can I take an electroplate of a form after it is set up? A. Take a wax or plaster cast of the form, coat it evenly with pure graphite or plumbago, connect by a copper wire with the zinc pole of a battery, and suspend in a strong solution of sulphate of copper in water, facing a plate of copper also suspended in the liquid and connected with the copper or carbon pole of the same battery. The connection between the wire and the film of graphite must be very perfect and secure. When the operation is properly conducted copper deposits over the film of graphite, copying the impression perfectly. When the film of copper is thick enough, it is dried, backed up with a fusible alloy or solder, removed from the mould, trimmed, and mounted on a block.

NEW BOOKS AND PUBLICATIONS.

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[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

December 7, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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Doorways, method of making tight, G. B. Thompson, Pittston, Pa.
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Fire boxes, J. K. Street, Camden, N. J.
Screw nut, W. Courtenay, New York city
Sugar, manufacture of, M. de la Vega *et al.*, N. Y. city.
Tallow, manufacture of, M. de la Vega *et al.*, N. Y. city.
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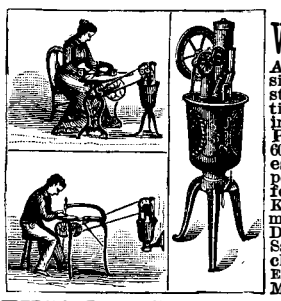

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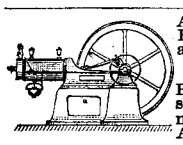

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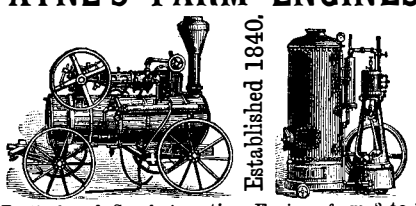

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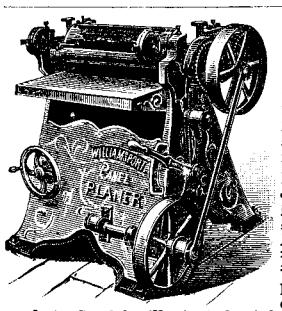

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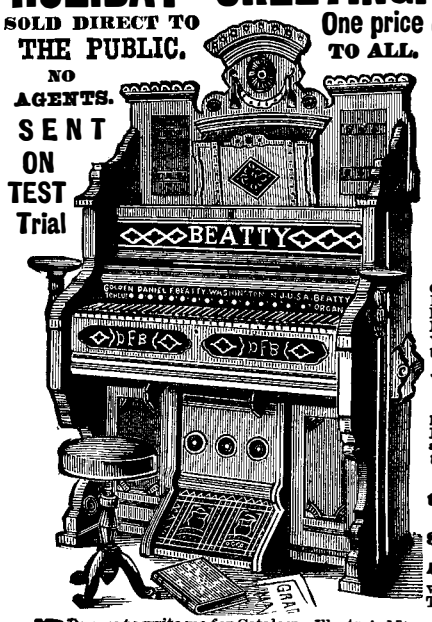

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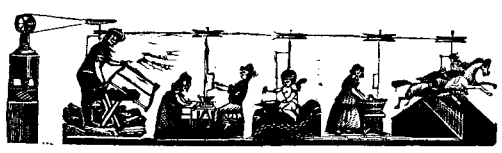

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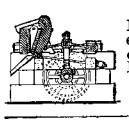

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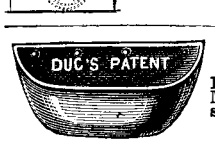

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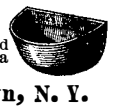

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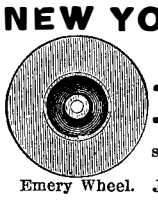

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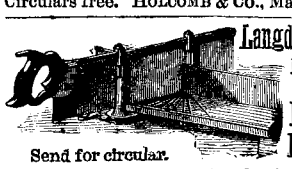

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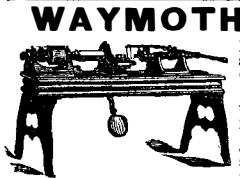

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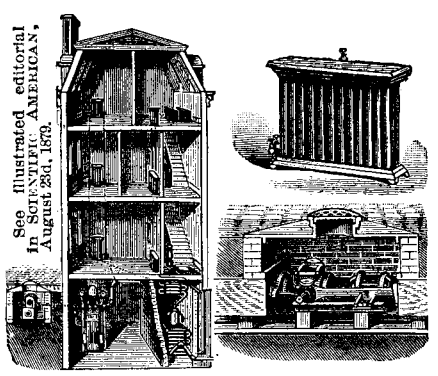

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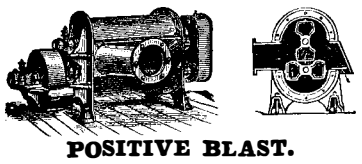

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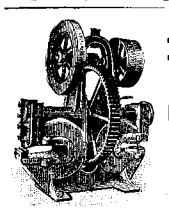

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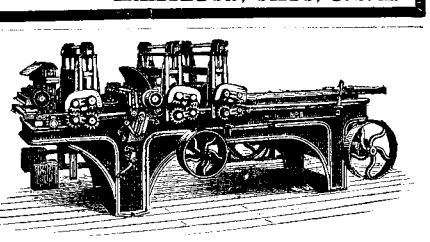

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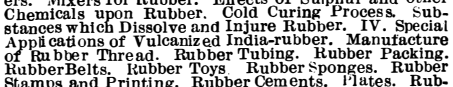

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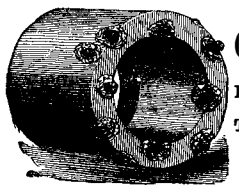

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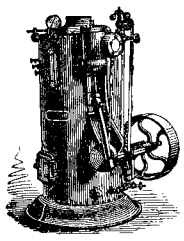

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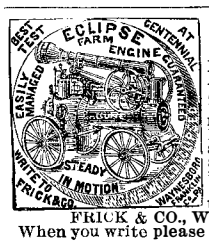

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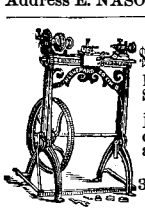

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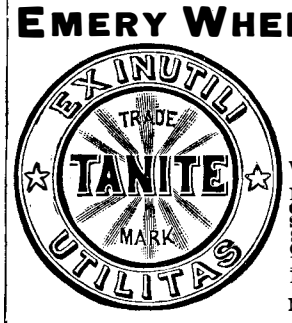

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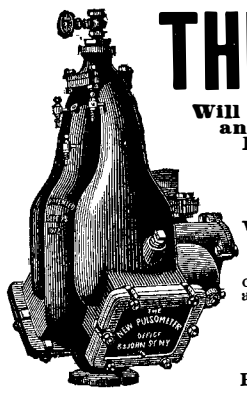

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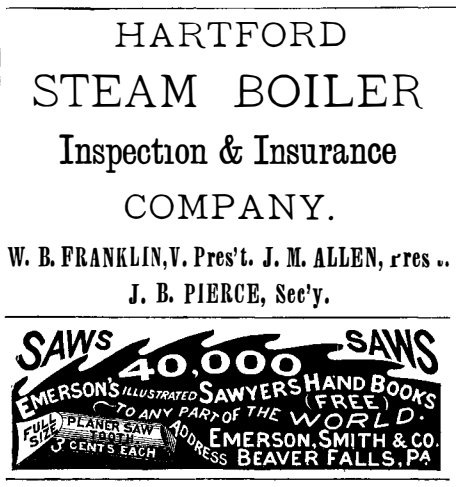

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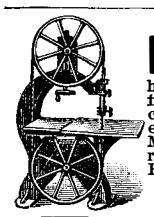

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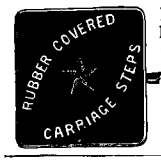

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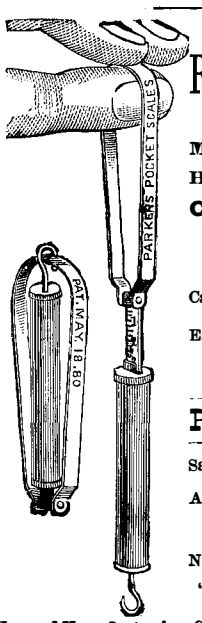

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